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INTRODUCTION TO LOGIC



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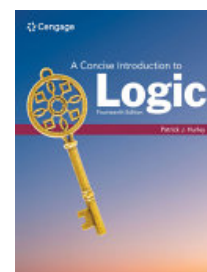
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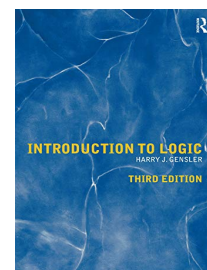
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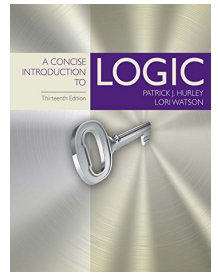
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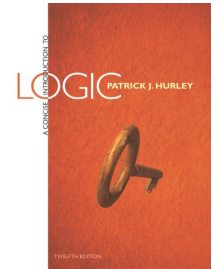
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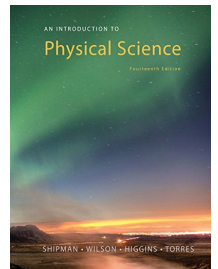
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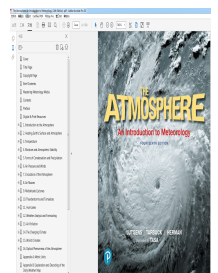
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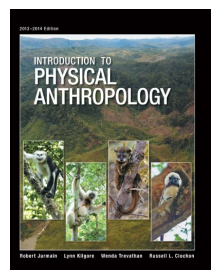
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Introduction to Logic
Irving M. Copi Carl Cohen
Kenneth McMahon
Fourteenth Edition

Biography

Aristotle

Of all the great philosophers and logicians, ancient and modern, none is greater than Aristotle (384–322 BCE), whose works and influence largely ruled the world of intellect for two millennia. He was often referred to as “The Philosopher”; his authority (even when he was mistaken!) was rarely questioned.

Born in Macedonia, in the city of Stagira, where his father was physician to the king, he was viewed from birth as a member of the aristocracy, and was a friend of the king’s son, Philip. When Philip became king of Macedonia, he summoned Aristotle, who had for many years been studying in Athens at Plato’s school, The Academy, to return to Macedonia as tutor to his son Alexander (who later would be known as Alexander the Great). As he advanced on his subsequent conquests in Asia, Alexander remained in contact with his respected teacher, sending back, at Aristotle’s request, specimens and artifacts that contributed to the early growth of the sciences.

Aristotle—one of the trio, with Plato and Socrates, who largely founded Western philosophy—had a truly encyclopedic mind. He investigated, contributed to, wrote about, and taught virtually all subjects on which some knowledge had been accumulated at his time: the natural sciences (biology, zoology, embryology, anatomy, astronomy, meteorology, physics, and optics); the arts (poetry, music, theater, and rhetoric); government and politics; psychology and education; economics; ethics; metaphysics—and of course logic, of which he alone was the systematic founder. His treatises on logic, later combined into one great work entitled *The Organon* (“The Instrument”), constitute the earliest formal study of our subject. The penetration and coherence of his logical analyses, and the comprehensiveness and general accuracy of his scientific studies, justify his acknowledged status as one of the finest thinkers ever to have graced our planet.

At the age of 49 Aristotle returned to Athens and established his own highly influential school, the Lyceum, where he taught for twelve years. He died of natural causes in 322 BCE. In his will, he asked to be buried next to his wife, Pythias.

In logic Aristotle grasped the overriding necessity of determining the rules of correct reasoning. He explained validity and characterized the four fundamental types of categorical propositions and their relations. In the *Prior*



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Analytics, one of the six books of *The Organon*, he developed a sophisticated theoretical account of categorical syllogisms, an account that long dominated the realm of deductive logic and that remains today an effective tool of sound reasoning.

It is said of Aristotle that he was probably the last person to know everything there was to be known in his own time. ■



There are many propositions about whose truth we are uncertain. “There is life on some other planet in our galaxy,” for example, is a proposition that, so far as we now know, may be true or may be false. Its “truth value” is unknown, but this proposition, like every proposition, must be either true or false.

A question *asserts* nothing, and therefore it is not a proposition. “Do you know how to play chess?” is indeed a sentence, but that sentence makes no claim about the world. Neither is a command a proposition (“Come quickly!”), nor is an exclamation a proposition (“Oh my gosh!”). Questions, commands, and exclamations—unlike propositions—are neither true nor false.

When we assert some proposition, we do so using a sentence in some language. However, the proposition we assert is not identical to that sentence. This is evident because two different sentences, consisting of different words differently arranged, may have the same meaning and may be used to assert the very same proposition. For example, “Leslie won the election” and “The election was won by Leslie” are plainly two different sentences that make the same assertion.

Sentences are always parts of some language, but propositions are not tied to English or to any given language. The four sentences

It is raining.	(English)
Está lloviendo.	(Spanish)
Il pleut.	(French)
Es regnet.	(German)

are in different languages, but they have a single meaning: all four, using different words, may be uttered to assert the very same proposition. *Proposition* is the term we use to refer to what it is that declarative sentences are typically used to assert.

The term **statement** is not an exact synonym of *proposition*, but it is often used in logic in much the same sense. Some logicians prefer *statement* to *proposition*, although the latter has been more commonly used in the history of logic. Other logicians eschew both terms as metaphysical, using only the term *sentence*.

Statement

A proposition; what is typically asserted by a declarative sentence, but not the sentence itself. Every statement must be either true or false, although the truth or falsity of a given statement may be unknown.

However, the concept of a proposition is seen by many as making a useful distinction between a sentence and what the sentence asserts..

The very same sentence can be used to make very different statements (or to assert very different propositions), depending on the context in which it is expressed. For example, the sentence, “The largest state in the United States was once an independent republic,” once expressed a true statement or proposition (about Texas), but if asserted today would express a false statement or proposition (about Alaska). The same words assert different propositions at different times.

Propositions may be *simple*, like those used in the preceding illustrations, but they may also be *compound*, containing other propositions within themselves. Consider the following proposition, from a recent account of the exploitation of the Amazon Basin in Brazil:

The Amazon Basin produces roughly 20 percent of the Earth’s oxygen, creates much of its own rainfall, and harbors many unknown species.¹

This sentence simultaneously asserts three propositions, concerning what the Amazon Basin produces and what it creates and what it harbors. The passage thus constitutes a *conjunctive* proposition. Asserting a conjunctive proposition is equivalent to asserting each of its component propositions separately.

Some compound propositions do not assert the truth of their components. In *disjunctive* (or *alternative*) *propositions*, no one of the components is asserted. Abraham Lincoln (in a message to Congress in December 1861) said, “Circuit courts are useful, or they are not useful.” This disjunctive proposition is plainly true, but either one of its components might be false.

Other compound propositions that do not assert their components are *hypothetical* (or *conditional*) *propositions*. The eighteenth-century freethinker, Voltaire, said, “If God did not exist, it would be necessary to invent him.” Here, again, neither of the two components is asserted. The proposition “God does not exist,” is not asserted, nor is the proposition, “it is necessary to invent him.” Only the “if-then” proposition is asserted by the hypothetical or conditional statement, and that compound statement might be true even if both of its components were false.

In logic, the internal structure of propositions is important. To evaluate an argument we need a full understanding of the propositions that appear in that argument. Propositions of many different kinds will be analyzed in this chapter.

B. Arguments

With propositions as building blocks, we construct *arguments*. In any argument we affirm one proposition on the basis of some other propositions. In doing this, an *inference* is drawn. **Inference** is a process that may tie together a cluster of propositions. Some inferences are *warranted* (or correct); others are not. The logician analyzes these clusters, examining the propositions with which the process begins and with which it ends, as well as the relations among these propositions.

Inference

A process by which one proposition is arrived at and affirmed on the basis of some other proposition or propositions.

Such a cluster of propositions constitutes an *argument*. Arguments are the chief concern of logic.

Argument is a technical term in logic. It need not involve disagreement, or controversy. In logic, **argument** refers strictly to any group of propositions of which one is claimed to follow from the others, which are regarded as providing support for the truth of that one. For every possible inference there is a corresponding argument.

In writing or in speech, a passage will often contain several related propositions and yet contain no argument. An argument is not merely a collection of propositions; it is a cluster with a structure that captures or exhibits some inference. We describe this structure with the terms *conclusion* and *premise*. The **conclusion** of an argument is the proposition that is affirmed on the basis of the other propositions of the argument. Those other propositions, which are affirmed (or assumed) as providing support for the conclusion, are the **premises** of the argument.

We will encounter a vast range of arguments in this text—arguments of many different kinds, on many different topics. We will analyze arguments in politics, in ethics, in sports, in religion, in science, in law, and in everyday life. Those who defend these arguments, or who attack them, are usually aiming to establish the truth (or the falsehood) of the conclusions drawn. As logicians, however, our interest is in the arguments as such. As agents or as citizens we may be deeply concerned about the truth or falsity of the conclusions drawn. However, as logicians we put those interests aside. Our concerns will be chiefly two. First, we will be concerned about the *form* of an argument under consideration, to determine if that argument is *of a kind* that is likely to yield a warranted conclusion. Second, we will be concerned about the *quality* of the argument, to determine whether it *does in fact* yield a warranted conclusion.

Arguments vary greatly in the degree of their complexity. Some are very simple. Other arguments, as we will see, are quite intricate, sometimes because of the structure or formulation of the propositions they contain, sometimes because of the relations among the premises, and sometimes because of the relations between premises and conclusion.

The simplest kind of argument consists of one premise and a conclusion that is claimed to follow from it. Each may be stated in a separate sentence, as in the following argument that appears on a sticker affixed to biology textbooks in the state of Alabama:

No one was present when life first appeared on earth. Therefore any statement about life's origins should be considered as theory, not fact.

Both premise and conclusion may be stated within the same sentence, as in this argument arising out of recent advances in the science of human genetics:

Since it turns out that all humans are descended from a small number of African ancestors in our recent evolutionary past, believing in profound differences between the races is as ridiculous as believing in a flat earth.²

Argument

Any group of propositions of which one is claimed to follow from the others, which are regarded as providing support or grounds for the truth of that one.

Conclusion

In any argument, the proposition to which the other propositions in the argument are claimed to give support, or for which they are given as reasons.

Premises

In an argument, the propositions upon which inference is based; the propositions that are claimed to provide grounds or reasons for the conclusion.

Biography

Chrysippus

Of all the logicians of ancient times, Aristotle and Chrysippus stand out as the two greatest. The enormous influence of Aristotle, who first systematized logic and was its principal authority for two thousand years, has already been recognized. Born a century later, Chrysippus (c. 279–c. 206 BCE) developed a conceptual scheme whose influence has only more recently been appreciated.

The logic of Aristotle was one of classes. In the Aristotelian argument “All men are mortal; Greeks are men; therefore Greeks are mortal,” the fundamental elements are the categories, or terms (“men,” “mortal things,” and “Greeks”). In contrast, the logic of Chrysippus was one built of *propositions* and the connections between them (e.g., “If it is now day, it is now light. It is now day. Therefore it is now light.”). This simple argument form (now called *modus ponens*) and many other fundamental argument forms, Chrysippus analyzed and classified. His logical insights were creative and profound.

Born in Asia Minor, in Soli, Chrysippus studied the philosophy of the Stoics—most famous among them Zeno and Cleanthes—and eventually became head of the Stoic school in Athens. In that capacity he taught the need to control one’s emotions, which he thought to be disorders or diseases. He urged the patient acceptance of the outcomes of a fate one cannot control, and the recognition that the one God (of which the traditional Greek gods are but aspects) is the universe itself.

But it is as a logician that his influence has been greatest. He grasped, as Aristotle did not, the central role of the proposition—“*that which is, in itself, capable of being denied or affirmed.*” From this base he developed the first coherent system of propositional logic. ■



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The order in which premises and conclusion appear can also vary, but it is not critical in determining the quality of the argument. It is common for the conclusion of an argument to *precede* the statement of its premise or premises. On the day Babe Ruth hit his 700th home run (13 July 1934), the following argument appeared in *The New York Times*:

A record that promises to endure for all time was attained on Navin Field today when Babe Ruth smashed his seven-hundredth home run in a lifetime career. It promises to live, first because few players in history have enjoyed the longevity on the diamond of the immortal Bambino, and, second, because only two other players in the history of baseball have hit more than 300 home runs.

This is an example of an argument whose two premises, each numbered, appear after the conclusion is stated. It is also an example of a very plausible argument whose conclusion is false, given that Hank Aaron hit his 700th home run on 21 July 1973, thirty-nine years later.

Even when premise and conclusion are united in one sentence, the conclusion of the argument may come first. The English utilitarian philosopher, Jeremy Bentham, presented this crisp argument in his *Principles of Legislation* (1802):

Every law is an evil, for every law is an infraction of liberty.

Although this is only one short sentence, it is an argument because it contains two propositions, of which the first (every law is an evil) is the conclusion and the second (every law is an infraction of liberty) is the premise. However, no single proposition can be an argument, because an argument is made up of a group of propositions. Yet some propositions, because they are compound, do sound like arguments, and care must be taken to distinguish them from the arguments they resemble. Consider the following hypothetical proposition:

If a state aims to be a society composed of equals, then a state that is based on the middle class is bound to be the best constituted.

Neither the first nor the second component of this proposition is asserted. All that is asserted is that the former implies the latter, and both might well be false. No inference is drawn, no conclusion is claimed to be true. Aristotle, who studied the constitution and quality of actual states in Greece more than two thousand years ago, wrote confidently in *Politics*, Book IV, Chapter 11:

A state aims at being a society composed of equals, and therefore a state that is based on the middle class is bound to be the best constituted.

In this case we *do* have an argument. This argument of Aristotle is short and simple; most arguments are longer and more complicated. Every argument, however—short or long, simple or complex—consists of a group of propositions of which one is the conclusion and the other(s) are the premises offered to support it.

Although every argument is a structured cluster of propositions, not every structured cluster of propositions is an argument. Consider this very recent account of global inequality:

In the same world in which more than a billion people live at a level of affluence never previously known, roughly a billion other people struggle to survive on the purchasing power equivalent of less than one U.S. dollar per day. Most of the world's poorest people are undernourished—lack access to safe drinking water or even the most basic health services and cannot send their children to school. According to UNICEF, more than 10 million children die every year—about 30,000 per day—from avoidable, poverty-related causes.³

This report is deeply troubling—but there is no argument here.

Reasoning is an art, as well as a science. It is something we do, as well as something we understand. Giving reasons for our beliefs comes naturally, but skill in the art of building arguments, and testing them, requires practice. One

who has practiced and strengthened these skills is more likely to reason correctly than one who has never thought about the principles involved. Therefore we provide in this chapter very many opportunities for practice in the analysis of arguments.

EXERCISES

Identify the premises and conclusions in the following passages. Some premises do support the conclusion, others do not. Note that premises may support conclusions directly or indirectly and that even simple passages may contain more than one argument.

EXAMPLE

1. A well-regulated militia being necessary to the security of a free state, the right of the people to keep and bear arms shall not be infringed.
—*The Constitution of the United States*, Amendment 2

SOLUTION

Premise: A well-regulated militia is necessary for the security of a free state.

Conclusion: The right of the people to keep and bear arms shall not be infringed.

2. What stops many people from photocopying a book and giving it to a pal is not integrity but logistics; it's easier and inexpensive to buy your friend a paperback copy.
—Randy Cohen, *The New York Times Magazine*, 26 March 2000
3. Thomas Aquinas argued that human intelligence is a gift from God and therefore “to apply human intelligence to understand the world is not an affront to God, but is pleasing to him.”
—Recounted by Charles Murray in *Human Accomplishment* (New York: HarperCollins, 2003)
4. Sir Edmund Hillary is a hero, not because he was the first to climb Mount Everest, but because he never forgot the Sherpas who helped him achieve this impossible feat. He dedicated his life to helping build schools and hospitals for them.
—Patre S. Rajashekhar, “Mount Everest,” *National Geographic*, September 2003
5. Standardized tests have a disparate racial and ethnic impact; white and Asian students score, on average, markedly higher than their black and Hispanic peers. This is true for fourth-grade tests, college entrance exams, and every other assessment on the books. If a racial gap is evidence of discrimination, then all tests discriminate.
—Abigail Thernstrom, “Testing, the Easy Target,” *The New York Times*, 15 January 2000
6. Good sense is, of all things in the world, the most equally distributed, for everybody thinks himself so abundantly provided with it that even

those most difficult to please in all other matters do not commonly desire more of it than they already possess.

—René Descartes, *A Discourse on Method*, 1637

7. When Noah Webster proposed a *Dictionary of the American Language*, his early 19th-century critics presented the following argument against it: “Because any words new to the United States are either stupid or foreign, there is no such thing as the American language; there’s just bad English.”

—Jill Lepore, “Noah’s Mark,” *The New Yorker*, 6 November 2006

8. The death penalty is too costly. In New York State alone taxpayers spent more than \$200 million in our state’s failed death penalty experiment, with no one executed.

In addition to being too costly, capital punishment is unfair in its application. The strongest reason remains the epidemic of exonerations of death row inmates upon post-conviction investigation, including ten New York inmates freed in the last 18 months from long sentences being served for murders or rapes they did not commit.

—L. Porter, “Costly, Flawed Justice,” *The New York Times*, 26 March 2007

9. Houses are built to live in, not to look on; therefore, let use be preferred before uniformity.

—Francis Bacon, “Of Building,” in *Essays*, 1597

10. To boycott a business or a city [as a protest] is not an act of violence, but it can cause economic harm to many people. The greater the economic impact of a boycott, the more impressive the statement it makes. At the same time, the economic consequences are likely to be shared by people who are innocent of any wrongdoing, and who can ill afford the loss of income: hotel workers, cab drivers, restaurateurs, and merchants. The boycott weapon ought to be used sparingly, if for no other reason than the harm it can cause such bystanders.

—Alan Wolfe, “The Risky Power of the Academic Boycott,” *The Chronicle of Higher Education*, 17 March 2000

11. Ethnic cleansing was viewed not so long ago as a legitimate tool of foreign policy. In the early part of the 20th century forced population shifts were not uncommon; multicultural empires crumbled and nationalism drove the formation of new, ethnically homogenous countries.

—Belinda Cooper, “Trading Places,” *The New York Times Book Review*, 17 September 2006

12. If a jury is sufficiently unhappy with the government’s case or the government’s conduct, it can simply refuse to convict. This possibility puts powerful pressure on the state to behave properly. For this reason a jury is one of the most important protections of a democracy.

—Robert Precht, “Japan, the Jury,” *The New York Times*, 1 December 2006

13. Without forests, orangutans cannot survive. They spend more than 95 percent of their time in the trees, which, along with vines and termites,

provide more than 99 percent of their food. Their only habitat is formed by the tropical rain forests of Borneo and Sumatra.

—Birute Galdikas, “The Vanishing Man of the Forest,” *The New York Times*, 6 January 2007

14. Omniscience and omnipotence are mutually incompatible. If God is omniscient, he must already know how he is going to intervene to change the course of history using his omnipotence. But that means he can’t change his mind about his intervention, which means he is not omnipotent.

—Richard Dawkins, *The God Delusion* (New York: Houghton Mifflin, 2006)

15. Reason is the greatest enemy that faith has; it never comes to the aid of spiritual things, but more frequently than not struggles against the divine Word, treating with contempt all that emanates from God.

—Martin Luther, *Last Sermon in Wittenberg*, 17 January 1546

3 Recognizing Arguments

Before we can evaluate an argument, we must *recognize* it. We must be able to distinguish argumentative passages in writing or speech. Doing this assumes, of course, an understanding of the language of the passage. However, even with a thorough comprehension of the language, the identification of an argument can be problematic because of the peculiarities of its formulation. Even when we are confident that an argument is intended in some context, we may be unsure about which propositions are serving as its premises and which as its conclusion. As we have seen, that judgment cannot be made on the basis of the order in which the propositions appear. How then shall we proceed?

A. Conclusion Indicators and Premise Indicators

One useful method depends on the appearance of certain common indicators, certain words or phrases that typically serve to signal the appearance of an argument’s conclusion or of its premises. Here is a partial list of **conclusion indicators**:

therefore	for these reasons
hence	it follows that
so	I conclude that
accordingly	which shows that
in consequence	which means that
consequently	which entails that
proves that	which implies that
as a result	which allows us to infer that
for this reason	which points to the conclusion that
thus	we may infer

Conclusion indicator

A word or phrase (such as “therefore” or “thus”) appearing in an argument and usually indicating that what follows it is the conclusion of that argument.

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a vast collection of ebooks across various genres, available in popular formats like PDF, EPUB, and MOBI, fully compatible with all devices. Enjoy a seamless reading experience and effortlessly download high-quality materials in just a few simple steps. Plus, don't miss out on exciting offers that let you access a wealth of knowledge at the best prices!

Other words or phrases typically serve to mark the premises of an argument and hence are called **premise indicators**. Usually, but not always, what follows any one of these will be the premise of some argument. Here is a partial list of premise indicators:

since	as indicated by
because	the reason is that
for	for the reason that
as	may be inferred from
follows from	may be derived from
as shown by	may be deduced from
inasmuch as	in view of the fact that

B. Arguments in Context

The words and phrases we have listed may help to indicate the presence of an argument or identify its premises or conclusion, but such indicators do not necessarily appear. Sometimes it is just the meaning of the passage, or its setting, that indicates the presence of an argument. For example, during the intense controversy over the deployment of additional U.S. troops to Iraq in 2007, one critic of that deployment wrote:

As we send our young men and women abroad to bring order to Iraq, many of its so-called leaders have abandoned their posts. We have given the Iraqis an opportunity to iron out their differences and they throw it back in our faces. Iraq does not deserve our help.⁴

No premise indicators or conclusion indicators are used here, yet the argument is clear. Indicators are also absent in the following argument in Sam Harris's *Letter to a Christian Nation*, whose premises and conclusions are unmistakable:

Half the American population believes that the universe is 6,000 years old. They are wrong about this. Declaring them so is not "irreligious intolerance." It is intellectual honesty.⁵

Often, however, the force of an argument can be appreciated only when one understands the *context* in which that argument is presented. For example, the undergraduate admission system of the University of Michigan that gave a fixed number of extra points to all members of certain minority groups was held unconstitutional by the U.S. Supreme Court in *Gatz v. Bollinger* in 2003. Justice Ruth Bader Ginsburg dissented, defending the Michigan system with the following argument:

Universities will seek to maintain their minority enrollment . . . whether or not they can do so in full candor. . . . [They] may resort to camouflage. If honesty is the best policy, surely Michigan's accurately described, fully disclosed College affirmative action program is preferable to achieving similar numbers through winks, nods, and disguises.⁶

This argument derives its force from the realization that universities had in fact long disguised their preferential admission programs to avoid attacks based

Premise indicator

In an argument, a word or phrase (like "because" and "since") that normally signals that what follows it are statements serving as premises.

on the equal protection clause of the 14th Amendment to the U.S. Constitution. Chief Justice William Rehnquist's response to Justice Ginsburg's argument is also intelligible only in the context of her defense of the preferential admission system. Rehnquist wrote the following:

These observations are remarkable for two reasons. First, they suggest that universities—to whose academic judgment we are told we should defer—will pursue their affirmative action programs whether or not they violate the United States Constitution. Second, they recommend that these violations should be dealt with, not by requiring the Universities to obey the Constitution, but by changing the Constitution so that it conforms to the conduct of the universities.⁷

Rehnquist's reference to "changing the Constitution" must be understood in light of the fact that the Michigan undergraduate admission system had been held unconstitutional. His reference to the pursuit of affirmative action programs "whether or not they violate the United States Constitution" can best be understood in light of Ginsburg's earlier reference to the possible use of "winks, nods, and disguises."

The full force of argument and counterargument can be grasped, in most circumstances, only with an understanding of the *context* in which those arguments are presented. In real life, context is critical. For example, if you are told that I am bringing a lobster home for dinner, you will have little doubt that I intend to eat it, not feed it.

C. Premises or Conclusions Not in Declarative Form

It is not uncommon for the premises of an argument to be presented in the form of questions. However, if questions assert nothing, and do not express propositions, how is this possible? On the surface they make no assertions; beneath the surface an interrogative sentence can serve as a premise when its question is **rhetorical**—that is, when it suggests or assumes an answer that is made to serve as the premise of an argument. The sentence may be interrogative even though its meaning is declarative.

This use of questions is sometimes obvious, as in a letter dated 7 January 2007 to *The New York Times*, objecting to a new series of U.S. coins that will honor former presidential wives. Irit R. Rasooly wrote:

I am irked by the new set of coins being issued. While some first ladies have influenced our country, should we bestow this honor on people who are unelected, whose only credential is having a prominent spouse?

Plainly, the critic means to affirm the proposition that we should not bestow this honor on such people. He continues:

Wouldn't honoring women who have served as governors, Supreme Court justices or legislators be a more fitting tribute to this nation's women than coins featuring "First Spouses"?

This critic obviously believes that honoring such achievements would be a more fitting tribute, but he again expresses that proposition with a question. His

Rhetorical question

An utterance used to make a statement, but which, because it is in interrogative form and is therefore neither true nor false, does not literally assert anything.

letter also provides an illustration of the need to rely on context to interpret declarative statements that are actually made. The writer's report that he is "irked" by the new set of coins is no doubt true, but this statement is more than a mere description of his state of mind; he means to express the judgment that such a set of coins *ought not* be issued.

Using questions to express a premise is sometimes counterproductive, however, because it may invite answers (by the listener, or silently by the reader) that threaten the conclusion at which the argument aims. For example, the archbishop of the Anglican Church in Nigeria, who is an ardent opponent of homosexuality and views it as deeply sinful, argues thus:

Why didn't God make a lion to be a man's companion? Why didn't He make a tree to be a man's companion? Or better still, why didn't He make another man to be a man's companion? So even from the creation story you can see that the mind of God, God's intention, is for man and woman to be together.⁸

Conclusions drawn about God's intentions, using as premises questions that invite a myriad of different responses, may be undermined by the answers they elicit.

Questions can serve most effectively as premises when the answers assumed really do seem to be clear and inescapable. In such cases the readers (or hearers) are led to provide the apparently evident answers for themselves, thus augmenting the persuasiveness of the argument. Here is an example: Some who find euthanasia morally unacceptable reject the defense of that practice as grounded in the right to self-determination possessed by the terminally ill patient. They argue as follows:

If a right to euthanasia is grounded in self-determination, it cannot reasonably be limited to the terminally ill. If people have a right to die, why must they wait until they are actually dying before they are permitted to exercise that right?⁹

The question is forceful because its answer appears to be undeniable. It seems obvious that there is no good reason why, if people have a right to die grounded in self-determination, they must wait until they are dying to exercise that right. Hence (this critique concludes) the right to euthanasia, if there is one, cannot be limited to the terminally ill. The argument has much merit, but from the perspective of its religious advocates, it may prove to be a two-edged sword.

Arguments that depend on rhetorical questions are always suspect. Because the question is neither true nor false, it may be serving as a device to suggest the truth of some proposition while avoiding responsibility for asserting it. That proposition is likely to be dubious, and it may in fact be false. To illustrate: In 2007 Arab leaders in Jerusalem expressed great anxiety about the safety of the Al-Aqsa mosque when the Israeli government began construction of a ramp leading to the platform (also sacred to the Jews) on which that very holy mosque is

situated. In reviewing the situation, David Gelernter, an Israeli partisan asked: “Is it possible that Arab leaders are more interested in attacking Israel than protecting religious and cultural monuments?”¹⁰ Well, yes, that is possible, of course—but it may not be true, and the question framed in this way is plainly intended to cause the reader to believe that Arab leaders were being duplicitous in voicing their concerns. Did the author assert that such duplicity lay behind the Arab objections? No, he didn’t say that!

Gossip columnists thrive on suggestive questions. Celebrity tidbits commonly appear in the form, “Does Paris Hilton have any talent as an actress?” Similarly, in discussing social issues, rhetorical questions can be an effective method of covert assertion. When riots in France spread through Islamic neighborhoods, many wondered what motivated those rioters. Journalist Christopher Caldwell wrote:

Were they admirers of France’s majority culture, frustrated at not being able to join it on equal terms? Or did they simply aspire to burn to the ground a society they despised?¹¹

Accusers who protect themselves by framing their accusations in interrogative sentences may shield themselves from the indignant complaints of their target. “No,” they may insist, “that is not what I said!”

It is wise policy to refrain from arguing with questions.

In some arguments the conclusion appears in the form of an imperative. The reason, or reasons, we ought to perform a given act are set forth as premises, and we are then directed to act in that way. Thus in Proverbs 4:7 we read:

Wisdom is the principal thing; therefore get wisdom.

Here the second clause is a command, and a command, like a question, is neither true nor false and cannot express a proposition. Therefore, strictly speaking, it cannot be the conclusion of an argument. Nonetheless, it surely is meant to be the conclusion of an argument in this passage from Proverbs. How can we explain this apparent inconsistency? It is useful in many contexts to regard a command as no different from a proposition in which hearers (or readers) are told that they would be wise to act, or ought to act, in the manner specified in the command. Thus the conclusion of the argument in Proverbs may be rephrased as “Getting wisdom is what you should do.” Assertions of this kind may be true or false, as most will agree. What difference there is between a command to do something and a statement that it should be done is an issue that need not be explored here. By ignoring that difference (if there really is one), we are able to deal uniformly with arguments whose conclusions are expressed in this form.

Reformulations of this kind can clarify the roles of an argument’s constituent propositions. It is necessary to grasp the *substance* of what is being asserted, to understand which claims are serving to support which inferences, whatever their external forms. Some needed reformulations are merely grammatical. A

proposition that functions as a premise may take the form of a phrase rather than a declarative sentence. This is well illustrated in the following argumentative passage, whose conclusion is a very sharp criticism of the United States:

What is a failed state? It is one that fails to provide security for the population, to guarantee rights at home or abroad, or to maintain functioning democratic institutions. On this definition the United States is the world's biggest failed state.¹²

The second and third premises of this argument are compressed into phrases, but the propositions for which these phrases are shorthand are clear enough, and their critical role in the author's reasoning is evident.

D. Unstated Propositions

Arguments are sometimes obscure because one (or more) of their constituent propositions is not stated but is assumed to be understood. An illustration will be helpful here. The chair of the Department of Sociology at City College, CUNY, presented two strong but controversial arguments, in parallel, regarding the justifiability of the death penalty. The first premise of each argument is the hypothesis that the factual belief (of the proponent, or of the opponent, of the penalty) about what does in fact deter homicide is mistaken. The second premise of each argument, although entirely plausible, is not stated, leaving the reader the task of reconstructing it.

The first argument went like this:

If the proponent of the death penalty is incorrect in his belief that the [death] penalty deters homicide, then he is responsible for the execution of murderers who should not be executed.¹³

This argument relies on the unstated second premise: "No one should be executed to advance an objective that is not promoted by execution." Hence one who *mistakenly* believes that the objective (detering murders) is achieved by executing those convicted is responsible for the execution of murderers who should not be executed.

The second argument went like this:

If the opponent of the death penalty is incorrect in his belief that the death penalty doesn't deter, he is responsible for the murder of innocent individuals who would not have been murdered if the death penalty had been invoked.¹⁴

This argument relies on the unstated second premise: "Protecting the lives of innocent individuals from murder justifies the execution of murderers if other murderers are then deterred by the fear of execution." Hence one who *mistakenly* believes that the death penalty does not deter murderers is responsible for the lives of innocents who are subsequently murdered.

In each of these arguments the assumed but unstated second premise is plausible. One might find both arguments persuasive—leaving open for empirical investigation the question of whether, in fact, the death penalty does deter murder.

However, the force of each of the arguments depends on the truth of the unstated premise on which it relies.

A premise may be left unstated because the arguer supposes that it is unquestioned common knowledge. In the controversy over the cloning of human beings, one angry critic wrote:

Human cloning—like abortion, contraception, pornography and euthanasia—is intrinsically evil and thus should never be allowed.¹⁵

This is plainly an argument, but part of it is missing. The argument relies on the very plausible but unstated premise that “what is intrinsically evil should never be allowed.” Arguments in everyday discourse very often rely on some proposition that is understood but not stated. Such arguments are called **enthymemes**.

The unstated premise on which an enthymeme relies may not be universally accepted; it may be uncertain or controversial. An arguer may deliberately refrain from formulating that critical premise, believing that by allowing it to remain tacit, the premise is shielded from attack. For example, medical research using embryonic stem cells (cells found in the human embryo that can develop into other types of cells and into most types of tissue) is highly controversial. One U.S. senator used the following enthymeme in attacking legislation that would permit government financing of such research:

This research [involving the use of embryonic stem cells] is illegal, for this reason: The deliberate killing of a human embryo is an essential component of the contemplated research.¹⁶

The stated premise is true: Research of this kind is not possible without destroying the embryo. However, the conclusion that such research is illegal depends on the unstated premise that the killing of a human embryo is illegal—and *that* claim is very much in dispute.

The effectiveness of an enthymeme may depend on the hearer’s knowledge that some proposition is false. To emphasize the falsity of some proposition, a speaker may construct an argument in which the first premise is a hypothetical proposition of which the antecedent (the “if” component), is the proposition whose falsity the speaker wishes to show, and the consequent (the “then” component) is a proposition known by everyone to be false. The unstated falsehood of this second component is the second premise of the enthymematic argument. The unstated falsehood of the first component is the conclusion of the argument. To illustrate: The distinguished political philosopher John Rawls admired Abraham Lincoln as the president who most appreciated the moral equality of human beings. Rawls frequently quoted Lincoln’s enthymematic argument, “If slavery is not wrong, nothing is wrong.”¹⁷ It is of course wildly false to say that nothing is wrong—from which it follows that it is equally false to say that slavery is not wrong. Similarly, distinguished psychiatrist Bruno Bettelheim, survivor of both Dachau and Buchenwald, wrote: “If all men are good, then there never was an Auschwitz.”

Enthymeme

An argument that is stated incompletely, the unstated part of it being taken for granted.

4 Arguments and Explanations

Passages that appear to be arguments are sometimes not arguments but *explanations*. The appearance of words that are common indicators—such as “because,” “for,” “since,” and “therefore”—cannot settle the matter, because those words are used both in explanations and in arguments (although “since” can sometimes refer to temporal succession). We need to know the intention of the author. Compare the following two passages:

1. Lay up for yourselves treasures in heaven, where neither moth nor rust consumes and where thieves do not break in and steal. For where your treasure is, there will your heart be also.

—Matt. 7:19

2. Therefore is the name of it [the tower] called Babel; because the Lord did there confound the language of all the earth.

—Gen. 11:19

The first passage is clearly an argument. Its conclusion, that one ought to lay up treasures in heaven, is supported by the premise (here marked by the word “for”) that one’s heart will be where one’s treasure is laid up. The second passage, which uses the word “therefore” quite appropriately, is not an argument. It *explains* why the tower (whose construction is recounted in Genesis) is called Babel. The tower was given this name, we are told, because it was the place where humankind, formerly speaking one language, became confounded by many languages—the name is derived from a Hebrew word meaning “to confound.” The passage assumes that the reader knows that the tower had that name; the intention is to explain why that name was given to it. The phrase, “Therefore is the name of it called Babel,” is not a conclusion but a completion of the explanation of the naming. In addition, the clause, “because the Lord did there confound the language of all the earth,” is not a premise; it could not serve as a reason for believing that Babel was the name of the tower, because the fact that that *was* the name is known by those to whom the passage is addressed. In this context, “because” indicates that what follows will *explain* the giving of that name, Babel, to that tower.

These two passages illustrate the fact that superficially similar passages may have very different functions. Whether some passage is an argument or an explanation depends on the *purpose* to be served by it. If our aim is to establish the truth of some proposition, *Q*, and we offer some evidence, *P*, in support of *Q*, we may appropriately say “*Q* because *P*.” In this case we are giving an argument *for* *Q*, and *P* is our premise. Alternatively, suppose that *Q* is known to be true. In that case we don’t have to give any reasons to support its truth, but we may wish to give an account of *why* it is true. Here also we may say “*Q* because *P*”—but in this case we are giving not an argument *for* *Q*, but an explanation *of* *Q*.

In responding to a query about the apparent color of quasars (celestial objects lying far beyond our galaxy), one scientist wrote:

The most distant quasars look like intense points of infrared radiation. This is because space is scattered with hydrogen atoms (about two per cubic meter) that absorb blue light, and if you filter the blue from visible white light, red is what's left. On its multibillion-light-year journey to earth quasar light loses so much blue that only infrared remains.¹⁸

The author is not seeking to convince his reader that quasars have the apparent color they do, but rather giving the causes of this fact; he is explaining, not arguing.

However, it may be difficult at times to determine whether an author intends to be explaining some state of affairs, or to be arguing for some conclusion that is critical in that explanation. Here, for example, is a passage that may be interpreted in either way.

I would like to highlight another property of water, unique but also vital to making life on Earth possible. As water cools, approaching its freezing point, its density suddenly decreases, reversing the usual "natural convection" patterns in which colder fluids sink. This reversal causes the coldest strata of water to rise to the top of an ocean or lake. These large bodies of water now freeze from the top down. Were it not for this unique property of water, the oceans and lakes would have long and completely frozen over from the bottom up with dire consequences for any life-sustaining liquid water on Earth.¹⁹

More than one conclusion may be inferred from the same premise, thus presenting two arguments. Similarly, more than one thing may be accounted for by the same fact, thus presenting two explanations. Here is an illustration:

The *Oxford English Dictionary* is a historical dictionary, providing citations meant to show the evolution of every word, beginning with the earliest known usage. Therefore, a key task, and a popular sport for thousands of volunteer word aficionados, is antedating: finding earlier citations than those already known.²⁰

That antedating is a key task for the makers of that dictionary is accounted for by the fact that the *Oxford English Dictionary* is a *historical* dictionary. This fact about the dictionary also explains why, for word aficionados, antedating is a popular sport.

If an author writes "Q because P," how can we tell whether he intends to explain or to persuade? We can ask: What is the status of Q in that context? Is Q a proposition whose truth needs to be established or confirmed? In that case, "because P" is probably offering a premise in its support; "Q because P" is in that instance an argument. Or is Q a proposition whose truth is known, or at least not in doubt in that context? In that case, "because P" is probably offering some account of why Q has come to be true; "Q because P" is in that instance an explanation.

In an explanation, one must distinguish *what* is being explained from what the explanation *is*. In the explanation from Genesis given at the beginning of this section, what is being explained is how the tower of Babel came to have that name; the explanation is that it was there that the Lord did confound the language of all the Earth. In the astronomical example given subsequently, what is

being explained is the fact that quasars appear to be red; the explanation is that as light travels from the very distant quasar to Earth all the blue in that light is filtered out.

If we are sensitive to the context, we will usually be able to distinguish an explanation from an argument. However, there will always be some passages whose purpose is uncertain, and such passages may deserve to be given alternative, equally plausible “readings”—viewed as arguments when interpreted in one way and as explanations when interpreted in another.

EXERCISES

Some of the following passages contain explanations, some contain arguments, and some may be interpreted as either an argument or an explanation. What is your judgment about the chief function of each passage? What would have to be the case for the passage in question to be an argument? To be an explanation? Where you find an argument, identify its premises and conclusion. Where you find an explanation, indicate what is being explained and what the explanation is.

EXAMPLE

1. Humans have varying skin colors as a consequence of the distance our ancestors lived from the Equator. It's all about sun. Skin color is what regulates our body's reaction to the sun and its rays. Dark skin evolved to protect the body from excessive sun rays. Light skin evolved when people migrated away from the Equator and needed to make vitamin D in their skin. To do that they had to lose pigment. Repeatedly over history, many people moved dark to light and light to dark. That shows that color is not a permanent trait.

—Nina Jablonski, “The Story of Skin,” *The New York Times*, 9 January 2007

SOLUTION

This is essentially an explanation. *What* is being explained is the fact that humans have varying skin colors. The explanation is that different skin colors evolved as humans came to live at different distances from the Equator and hence needed different degrees of protection from the rays of the sun. One might interpret the passage as an argument whose conclusion is that skin color is not a permanent trait of all humans. Under this interpretation, all the propositions preceding the final sentence of the passage serve as premises.

2. David Bernstein [in *Only One Place of Redress: African Americans, Labor Regulations, and the Courts from Reconstruction to the New Deal*, 2001] places labor laws at the center of the contemporary plight of black Americans.

Many of these ostensibly neutral laws (e.g., licensing laws, minimum-wage laws, and collective bargaining laws) were either directly aimed at stymieing black economic and social advancement or, if not so aimed, were quickly turned to that use. A huge swath of the American labor market was handed over to labor unions from which blacks, with few exceptions, were totally excluded. The now longstanding gap between black and white unemployment rates dates precisely from the moment of government intervention on labor's behalf. In short (Bernstein argues) the victories of American labor were the undoing of American blacks.

—Ken I. Kirsch, "Blacks and Labor—the Untold Story," *The Public Interest*, Summer 2002

3. Animals born without traits that led to reproduction died out, whereas the ones that reproduced the most succeeded in conveying their genes to posterity. Crudely speaking, sex feels good because over evolutionary time the animals that liked having sex created more offspring than the animals that didn't.

—R. Thornhill and C. T. Palmer, "Why Men Rape," *The Sciences*, February 2000

4. Changes are real. Now, changes are only possible in time, and therefore time must be something real.

—Immanuel Kant, *Critique of Pure Reason* (1781),
"Transcendental Aesthetic," section II

5. The nursing shortage in the United States has turned into a full-blown crisis. Because fewer young people go into nursing, one-third of registered nurses in the United States are now over 50 years of age, and that proportion is expected to rise to 40 percent over the next decade. Nurses currently practicing report high rates of job dissatisfaction, with one in five seriously considering leaving the profession within the next five years. . . . Hospitals routinely cancel or delay surgical cases because of a lack of nursing staff.

—Ronald Dworkin, "Where Have All the Nurses Gone?,"
The Public Interest, Summer 2002

6. To name causes for a state of affairs is not to excuse it. Things are justified or condemned by their consequences, not by their antecedents.

—John Dewey, "The Liberal College and Its Enemies," *The Independent*, 1924

7. One may be subject to laws made by another, but it is impossible to bind oneself in any matter which is the subject of one's own free exercise of will. . . . It follows of necessity that the king cannot be subject to his own laws. For this reason [royal] edicts and ordinances conclude with the formula, "for such is our good pleasure."

—Jean Bodin, *Six Books of the Commonwealth*, 1576

8. I like Wagner's music better than anybody's. It is so loud that one can talk the whole time without people hearing what one says.

—Oscar Wilde, *The Picture of Dorian Gray*, 1891

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Islandia hodie dicitur, facile doctis viris assentior.” He adds that Eratosthenes held Pytheas to be an oracle, but when Polybius and others found his geography loose in points familiar to the Greeks, they pronounced him a liar, and rejected all he wrote.

I must therefore conclude that Pytheas, with all his fables, by Thule meant Iceland, and Iceland only; moreover, that he had acquired some knowledge of the island. Indeed Gosselin opined that both Pytheas and Eratosthenes had had access to the memoirs of some unknown ancient people to whom Europe and its seas were as well known as to ourselves. He argues that this people could not have been Babylonians, Phœnicians, Carthaginians, nor Egyptians. Bailly (Hist. de l’Astr. An., 1-3), entertaining a similar opinion, supposes them, after the fashion of the day, to be Antediluvians.

MELA.

Pomponius Mela (A.D. 41-54; De Situ Orbis, iii. 6) is our next authority. After mentioning Britannia and Iverna, the thirty islands of the Orcades, the seven Hæmodæ (Shetlands) fronting Germany,^[7] and the Scandinavian Isle held by the Teutons,^[8] he says:

“Thule fronts the seaboard of the Belcæ (alii Belgæ and Bergæ),^[9] an island celebrated in the Greek poetry and in our own. There, as the sun rises to set afar off, the nights are indeed short; but during winter, as in other places, obscure; in summer they are light, because throughout that season (the sun), already raising himself higher (above the horizon), despite not being seen, yet illuminates the nearest parts by his approaching splendour. At the solstices there is no darkness, because then (the sun), becoming more manifest, shows not only his rays, but the greater part” (of his disc).

PLINY.

The next authority is Pliny (nat. A.D. 23, ob. A.D. 79), who makes Thule the northernmost British island. Both he and Cæsar (Bell. Gall., v. 13), placing Mona about N. lat. 66°, declare that the sun does not set in summer, but perpetually disappears during the winter solstice. To the former phase Cæsar assigns thirty days, Pliny six months (*senis mensibus*). The great natural philosopher mentions the Massilian traveller without abusing him:

“Pytheas informs us that this is the case (*i.e.*, the day lasting six months, and the night being of equal length) in the island of Thule, which is six days’ sail from the north of Britain” (Nat. Hist., vol. i., book ii., chap. 77, Bostock and Riley, Bohn, 1835).

In book iv., chap. 30, occurs:

“The most remote of all that we find mentioned is Thule, in which, as we have previously stated, there is no night at the summer solstice, when the sun is passing through the sign of Cancer; while, on the other hand, at the winter solstice there is no day.”

Again (loc. cit.):

“There are writers also who make mention of some other islands, Scandia, namely, Damna, Bergos, and, greater than all, Nerigos (or Nerigo, Noreg, *i.e.*, Norway), from which persons embark for Thule. At one day’s sail from Thule, is the Frozen Ocean, which by some is called the Cronian Sea.”

Finally, in book vi., chap. 39, we find:

“The last of all is the Scythian parallel,^[10] which runs from the Riphæan range to Thule, in which, as we have already stated, the year is divided into days and nights alternately of six months’ duration.”

With these passages before us, it is easy to understand why popular writers generally assume Pliny’s Thule to be the Shetland Isles. But he evidently confirms the account of Pytheas, and adds the significant detail about the Cronian or Frozen Sea. It is well established that the ocean south of Iceland is not icy, whilst the northern and western shores are often frost-bound.

PTOLEMY.

Claudius Ptolemy, the Pelusian (flor. A.D. 159-161) notices *θούλη* in nine places. After correcting (book i., chap. 20, §§ 7, 8,^[11] = p. 17^[12]) the errors of Maximus of Tyre, he says (book i., chap. 24, § 4, = p. 19): “Consequently also the parallel passing through Thule shall be laid down as $\nu\beta'$ (52) sections from η to $\zeta\eta$, along the lines of latitude ξ , \omicron , π .” The same chapter (§ 6, = p. 20) tells us, “Also shall be comprehended the interval between \omicron and κ southwards, that is, between the parallels passing through Thule and through Rhodes $\kappa\zeta$ (27) sections.” Thirdly, the same chapter (§ 17, = p. 22) continues: “ κ , through which shall be described the line (of latitude) defining the north, and falling on the island of Thule.” Fourthly, in the same (§ 20, = p. 22), we find: “And as $\tau\omicron\mu\eta\kappa\omicron\varsigma$ (the longitude) is commensurable with $\tau\omicron\pi\lambda\acute{\alpha}\tau\omicron\varsigma$ (the latitude), since upon the sphere whose great circle is five, of these the parallel passing through Thule is about β and δ' ” ($2\frac{1}{4}$).

Book ii., chap. 3, § 32, = p.28, establishes the position of Thule:

“And above them (the Orkades) is the (island of) Thule, whose—

Western parts are in	E. long. (Ferro?)	29°	N lat. 63°
The Easternmost being in”	”	31° 40’”	63°
” Northernmost	”	30° 20’”	63° 15’
” Southernmost	”	30° 20’”	62° 40’
And the Mid Isle in,	”	30° 20’”	63° “

The sixth book (chap. 16, § 1, = p. 113) tells us:

“Serica is bounded west by Scythia beyond the Imaus mountain, according to the line laid down; on the north by an unknown land on the parallel passing through Thule; on the east by regions also unknown, along the meridional line whose limits are:

“E. long. 180’”	N. lat. 63°
” 18° ”	35°”

Again we find (book vii., chap. 5, § 12, = p. 125):

“But the northern part is bounded by the parallel which is north of the equinoctial line 63 parts (*i.e.*, N. lat. 63°), and this is described through Thule, the Island. So that the breadth of the known world is 76° 25’, or in round numbers, 80 degrees.”^[13]

Lastly (book viii., chap. 3, § 3, = p. 131) we are told:

“But the (Island) Thule has its greatest day of twenty equinoctial hours, and from Alexandria it is distant two equinoctial hours to the west.”^[14]

Thus Ptolemy's Thule is a long narrow island, 160 by 35 miles, and his description, despite the times in which he wrote, is applicable rather to North Britain and even to Iceland, than to Scandinavia. He is consistent in his assertions: (1.) That Thule is an island; (2.) That its northernmost point extends to $3^{\circ} 17'$ south of the Polar circle ($66^{\circ} 32'$); (3.) That it lies north of the Orcades.^[15] Manifestly we cannot rely upon the longitudes, Ptolemy's first meridian being still *sub judice*. The late Mr Hogg suggested^[16] that the zero of longitude was not, as usually assumed, at Ferro in the Fortunate Islands (W. long. (G.) $24^{\circ} 23' 40''$ to $24^{\circ} 34'$), but at "S. Antonio, Cape Verd Islands" (read São Antão^[17]) in W. long. (G.) $25^{\circ} 2' 40''$ to $25^{\circ} 25' 45''$ —a change which would give in round numbers a difference of fifty miles.^[18] Nothing more need be added upon this head. Pytheas and Eratosthenes evidently referred to Iceland; Mela did the same in making it front Bergen; Pliny heard of it when he relates that from Nerigos persons embark for Thule; and neglecting Ptolemy's latitudes and longitudes, his description tallies best with Iceland.

III.

THULE, PART OF GREAT BRITAIN

Of Thule applied to some part of Great Britain we have a multitude of instances, which are ably and lengthily brought together by Sir Robert Sibbald.^[19] Our writer begins by establishing the fact that the ancients connected the idea of darkness with the north.

“These places of Homer πρὸς ζόφον (ad caliginem), and οὐ γὰρ ἴδμεν ὅπου ζόφου (neque enim scimus ubi sit caligo), are by Strabo (ii. § 6) interpreted of the north, “Nescimus ubi sit Septentrio” (We know not where the north is).

He quotes Tibullus (nat. circ. B.C. 54; iv. 1, 154):

“Illic et densâ tellus absconditur umbrâ.”

And Pub. Papinius Statius (nat. circ. A.D. 61; Sylv., iii., Ad Claudiam Uxorem, v. 20):

“Vel super Hesperiae vada caligantia Thiles.”

Again (Sylv., iv. 4, 62):

“——aut nigræ littora Thule.”

And again (Sylv., v. 1, 90, 91):

“——quantum ultimus orbis,
Cesserit et refluo circumsona gurgite Thule.”

Strabo (book ii., chap. 4, § 8) is quoted to show by Pytheas, that Thule is “one of those islands that are called British,” and we have seen Strabo’s own opinion that it lies farther south than where the Massilian placed it. He quotes Catullus (B.C. 87; Ad Furium Carm., xii.):

“Sive trans altas gradietur Alpes,
Cæsaris visens monumenta magni,
Gallicum Rhenum, horribilesque ultimosque Britannos;”

and Horace (i. 35, 30):

“Serves iturum Cæsarem in ultimos
Orbis Britannos;”

to show that the Britons were the northernmost people then known. Due use is made of Silius Italicus (nat. circ. A.D. 25; Punic, lib. xvii., 417, 418):

“Cœrulus hand alitur cum dimicat incola Thule,
Agmina falcifero circumvenit arcta covino,”

for it appears from Cæsar's Commentaries, that the bluish colour and the fighting out of hooked chariots were in use among the inhabitants of Britain. Pliny also (N. H., iv. 30) treats of Thule in the same chapter where he treats of the British Isles, "ultima omnium quæ memoratum est Thule." Tacitus says (Agric. Vita, cap. x.) when the Roman navy sailed about Britain, "dispecta est et Thule."^[20]

'Ireland, properly so called, was the first of the British Isles which got the name Thule, being the first that the Carthaginians met with as they steered their course from Cadiz to the west; and hence it is that Statius (Ad Claud. Uxor., lib. iii., v. 20) calls Thule 'Hesperia,' and it seems to be the same that is said by (the pseudo) Aristotle (Liber de Mirab. Auscult) to have been discovered by the Carthaginians when he speaks thus (lxxxv.):

" 'In the sea beyond the Pillars of Hercules, they say, the Carthaginians found a fertile island uninhabited, abounding in wood and navigable rivers, and stored with very great plenty of fruits (*fructibus*) of all sorts,^[21] distant several days' voyage from the continent.'

And Bochartus (Geog. Sac.) confirms this by what he observes, that an ancient author, Antonius Diogenes,^[22] who wrote twenty-four books of the strange things (or Incredibilities) related of Thule,^[23] not long after the time of Alexander the Great, had his history from the Ciparis Tables, dug at Tyre out of the tombs of Mantinea and Dercilis (Dercyllides), who had gone from Tyre to Thule, and had stayed some time there. But though this be the first Thule discovered by the Carthaginians, yet it is not that mentioned by the Roman writers, for they speak of the Thule which the Romans were in and made a conquest of, but it is certain they were never in Iceland properly so called.

"That they were in Thule appears from Statius (Sylv., v. 2, 54):

" '——quantusque nigrantem
Fluctibus occiduis fessoque Hyperione Thulen
Intrârit mandata gerens.'

Now the father of Crispinus, to whom he writes, was Vectius Bolanus, governor of Britain, A.D. 69, under Vitellius (as Tacitus informs us), which is clearly proved by the same poet (Sylv., v. 2, 140-143):

" 'Quod si te magno tellus frenata parenti
Accipiat—
Quanta Caledonios attollet gloria campos!
Cum tibi longævus referet trucis incola terræ;
Hic suetus dare jura parens.'

The words 'Caledonios' and 'trucis incola terræ' clearly show that by Thule is meant the north part of Britain, which was then possessed by the Picts, designed by the name 'Caledonios,' and by the Scots, designed as 'trucis incola terræ,' the same epithet that Claudian (De Bell. Get., 416) gives to the Scots in these verses:

" 'Venit et extremis legio prætentâ Britannis,
Quæ Scoto dat fræna truci, ferroque notatas
Perlegit exsanguis Picto moriente figuras.'

And of this north part of Britain that verse of Juvenal (Sat., xv. 112):

“ ‘De conducendo loquitur jam rhetore Thule,’^[24]

is also to be understood. Of this the best exposition is taken from Tacitus (Agric., xxi.):

“ ‘Jam verò principum filios, liberalibus artibus erudire, et ingenia Britannorum studiis Gallorum anteferre, ut qui modò linguam Romanum abnuebant, eloquentiam concupiscerent.’

“Claudian (De III. Consul. Honor., 52-56) yet more particularly gives the name of Thule to the north part of Britain:

“ ‘Facta tui numerabat avi, quem littus adustæ
Horrescit Libyæ, ratibusque impervia Thule.
Ille leves Mauros, nec falso nomine Pictos
Edomuit, Scotumque vago mucrone secutus,
Fregit Hyperboreas remis audacibus undas.’

And in these lines (De IV. Consul. Honor., 26-33):

“ ‘Ille, Caledoniis posuit qui castra pruinis,
Qui medios Libyæ sub casside pertulit æstus,
Terribilis Mauro, debellatorque Britanni
Littoris, ac pariter Boreæ vastator et Austri.
Quid rigor æternus cœli, quid sidera prosunt?
Ignotumque fretum? Maduerunt Saxoue fuso,
Orcades: incaluit Pictorum sanguine Thule:
Scotorum cumulos flevit glacialis Ierne,’

where, by placing the Moors and Britons as the remotest people then known, and mentioning the Scots and Picts as the inhabitants of Thule and Ierne, he demonstrates clearly that Thule is the north part of the isle of Britain, inhabited by the Scots and Picts. For this Ierne, or, as some read it, ‘Hyberne,’ can no way be understood of Ireland properly so called; first, because Ireland can never deserve the epithet ‘glacialis,’^[25] since, by the testimony of the Irish writers, the snow and ice continue not any time there; secondly, the Romans were never in Ireland, whereas, according to the above-mentioned verses, Theodosius passed over the Friths of Forth and Clyde, called by him ‘Hyperboreæ undæ,’ and entered Strathearn, which to this day bears the name Ierne; in which Roman medals are found, and the Roman camps and military ways are to be seen—the undoubted testimonies of their being there; and therefore is so to be understood in the same poet’s lines upon Stilicho (see De Laud. Stilich., lib. ii., 250-254), who was employed in the British war:

“ ‘Me quoque vicinis pereuntem gentibus, inquit,
Me juvit Stilicho, totam cum Scotus Iernen
Movit, et infesto spumavit remige Tethys.
Illius effectum curis, ne tela timerem
Scotica, ne Pictum tremere.’

Now, Tethys in these verses, and the ‘undæ Hyperboreæ’ in the verses before mentioned, cannot be understood of the sea between Scotland and Ireland, for Ireland lies to the south of the Roman province, and the situation of the Scots’ and Picts’ country is to the north of it; for it was separated by the two Friths of Forth and Clyde from the Roman province, which clearly shows

it was to be understood of them: the same thing that is also imported by the words ‘Hyperboreas undas’ and ‘remis;’ for these cannot be understood of the Irish Sea, which is to the south of the Roman province, and is very tempestuous, and cannot so well be passed by oars as the Friths of Forth and Clyde. And the same poet has put this beyond all doubt (in the verses before quoted, De Bell. Get., 416).

“For were it to be understood of the Irish Sea, then the wall and the ‘prætenturæ’ (*legio prætenta*) should have been placed upon the Scottish shore that was over against that country, which is called Strathearn now, and is the true Ierne not only mentioned by Claudian, but also by Juvenal in these verses (I. Sat., ii. 160):

“ ‘Arma quidem ultra
Litora Juvenæ promovimus, et modò captas
Oreadas, ac minimâ contentos nocte Britannos.’

“That this Thule was a part of Britain, the Roman writers seem to be very clear, especially Silius Italicus in the verses before quoted.

“But to make it appear which part of Britain the Thule was which is mentioned by the Romans, it will be fit to see to which part of Britain the epithets attributed by writers to Thule do best agree. First, then, it was a remote part, ‘ultima Thule,’ as if this were the remotest part of Britain; so Tacitus (Agric., xxx.) brings in Galgacus expressing it, ‘We, the uttermost bounds of land and liberty,’ etc. Then Thule was towards the north, and so was this country with respect to the Roman province; and, thirdly, it might deserve the name Thule (darkness), because of its obscure and dark aspect, it being in those days all overgrown with woods. Fourthly, the length of the day annexed to Thule: and, upon this account, it must be the country to the north and to the east of Ierne, by the verses of Juvenal before mentioned (V. Sat., xv. 112).

“Another property of Thule given by Tacitus (loc. cit.) is that about it is ‘mare pigram et grave remigantibus,’ which agrees indeed to the sea upon the north-east part of Scotland, but not for the reason that Tacitus gives, *i.e.*, for want of winds, but because of the contrary tides which drive several ways, and stop not only boats with oars, but ships under sail.

“But Thule is most expressly described to be this very same country that we treat of by Conradus Celtes:

“ ‘Orcadibus quâ cincta suis Tyle et glacialis
Insula.’

“This same epithet Claudian (see p. 15) gives to Ierne, when he calls it ‘Glacialis Ierne;’ and this Thule he makes to be encompassed ‘suis Orcadibus,’ which isles lie over-against it; and a little after he gives it the like epithet with ‘mare pigrum.’

“ ‘Et jam sub septem spectant vaga rostra Trionos
Quâ Tyle est rigidis insula cincta vadis.’

And afterwards he makes the Orcades to lie over-against this Thule, and seems to have in his eye the skerries and weels in Pictland (Pentland?) Frith in these lines:

“ ‘Est locus Arctoo quàm se Germania tractu
cis Tyle ubi surgit aquis,
Quam juxta infamos scopuli et petrosa vorago
Asperat undisonis saxa pudenda vadis
Orcadas has memorant dictas a nomine Græco.’^[26]

“But the clearest testimony of all we owe to Arngrimus Jonas (*Specimen Islandicum*, A.D. 1593),^[27] when he brings in the verses of Fortunatus (*lib. viii., cap. 1*), who sings of St Hilarion (ob. A.D. 372):

“ ‘Eloquii currente rotâ penetravit ad Indos,
Ingeniumque potens ultima Thule colit.’

“And then reckoning up the several nations enlightened by him, he mentions Britain amongst the rest:

“ ‘Thrax, Italus, Scythia, Persa, Indus,
Geta, Dacia, Britannus.’^[28]

“To which he adds, ‘From whence it may fairly enough be inferred that either Britain or (as Pliny will have it) some island of Britain was the *ultima Thule*.’ And afterwards, ‘To confirm the opinion of Pliny and his followers, who will have some of the British Isles, or particularly, that farthest in the Scottish dominions to be Thule, I must acknowledge that the history of the kings of Norway says the same thing, in the life of King Magnus, who, in an expedition to the Orcades and Hebrides and into Scotland and Britain, touched also at the Island of Thule and subdued it.’

“By all this, I think, it appears sufficiently that the north-east part of Scotland, which Severus the emperor and Theodosius the Great infested with their armies, and in which, as Boethius^[29] shows us, Roman medals were found, is undoubtedly the Thule mentioned by the Roman writers; and this also, if we believe the learned Arngrimus Jonas, was meant by Ptolemy, where he saith, that, to the twenty-first parallel drawn through Thule by Ptolemy, the latitude answers to 55° 36′, so that our country in those ancient times passed under the name of Thule and Hibernia, and the ‘*Hiberni et Picti, incolæ Thules*’ are the same people who were afterwards called Scots.^[30]

“I shall only add one remark more, and that is, that we need not have recourse for the rise of the name Scot, to the fabulous account of the monks who bring it from Scota, Pharaoh’s daughter, married to Gathelus; since without that strain, if it be granted that the country was once called Thule, which in the Phœnician language signifies ‘darkness,’ we have a very fair reason for the name Scotia, which signifies the same in the Greek tongue. And it is very well known that it was usual with the Greeks (who next to the Phœnicians were the best navigators) not only to retain the Phœnician name of the place, but likewise to give one in their own language of the same import; and since the learned Bochartus has very ingeniously deduced the Greek name of the whole island, Βρετανική, from Bratanack and Barat anac,^[31] in the Phœnician tongue signifying ‘a land of tin’ (which the Greeks not only reduced to their own termination, but likewise called the British isles^[32] Κασσιτερίδες, that is, ‘lands of tin,’^[33] which is the signification of the Phœnician and Greek names); we may take the same liberty to

derive the Greek name Scotia from Phœnician Thule;^[34] but this is so fully treated of in the ‘Scotia Antiqua,’ that I need say no more.”

To these authorities may be added Silius Italicus (lib. iii., 597), who manifestly places “unknown Thule” about Scotland:

“Hinc pater ignotam donabit vincere Thulen
Inque Caledonios primus trahit agmina lucos.”

R. Festus Avienus (Descr. Orb. Ter.), metaphrasing Dionysius, treats of Thule when speaking of Britain, and yet gives “the unknown island” an Arctic day:

“Longa dehinc celeri si quis rate marmora currat,
Inveniet vasto surgentem gurgite Thulen;
Hinc cūm plastra poli tangit Phœbeius ignis
Nocte sub inlustri rota solis fomite flagrat
Continuò clarumque diem nox œacula ducit.”

We have also the testimony of Richard of Cirencester (Ricardus Coronensis, ob. circ. A.D. 1401), who tells us (De Situ Britanniae) that in the time of the later emperors, “Thule” was applied to Valentia or Valentiana, the district between the wall of Severus and the rampart of Antoninus, including the south part of Scotland, Northumberland, and a portion of Cumberland.

It might have been supposed that the distinct mention of the Orcades and Hebrides^[35] by Pliny (N. H., lib. iv., cap. 30), and by Ptolemy (lib. ii., cap. 3, § 32, = p. 28), would have barred their claim to the classic title. This is far from being the case. John Brand (A Brief Description of Orkney, etc., Edin. 1701, Pinkerton, iii., p. 782), after quoting Claudian and Conradus Celtes, with others who call Thule “Britannicarum insularum septentrionissimam,” thus disposes of Iceland:

“I greatly doubt if ever the Romans had the knowledge of Iceland, their eagles never having come and been displayed to the north of Scotland or Orkney. ‘Imperii fuerat Romani Scotia limes,’ saith the great Scaliger. Ptolemy will have it to be among the Isles of Zetland; and Boethius, our historian (Boethius, in p. 740, also in p. 755, which quotes from his life of Mainus, king of Scots), distinguisheth between a first and a second Thule, calling Ila the first, and Louisa the second, which are reckoned among the isles called Hebrides. ‘Ptolemæus inter Schethlandicas insulas, quæ ultra Orchades sunt, ant proxime Norwegiam sitam vult, haud quaquam propter immensam intercapedinem intelligi potest, nos autem Ilam (Islay?) primam Leuisam (Lewis) Hebridum præstantissimam secundam Thulen vocamus.’ But I am inclined to think that although some might design a particular place by the Thule, yet generally by a synecdoche, usual with the Roman authors, they might denote all those places remote from them to the north, and especially Britain and the northern parts thereof, whither their arms did come.”

The Shetland claimants take another line of argument. Eutropius (A.D. 330-375, lib. vii.) makes the emperor Claudius, during his invasion of Britain (A.D. 43) annex the Orkneys: “Quasdam insulas etiam ultra Britanniam, in oceano positas, Romano imperio addidit, quæ appellantur Orcades.” Pliny, they say, endorses Pytheas Massiliensis, who writes that Thule is six days’ sail north of Britain. Tacitus (loc. cit.) declares that Agricola sailed round Britain, conquered the Orcades, and saw Thule. The latter cannot be the Orcades or Hebrides, because both are mentioned by Pliny, and as their northerly point is not so far north as Cape Wrath, they could hardly be described as “ultra Britanniam.” Caithness and other parts of Scotland are put out of court, since they are all to the south of Orkney, and therefore not beyond it. The Færoes and Iceland are excluded, because they were both too distant to be visited by the frail galleys of

the Romans, unaided as they were, either by the compass or the science of navigation, and they could not possibly have been seen from Orkney. The same arguments apply to the Norwegian coast, which also is not an island, and is not situated north of Britain.

By this “process of elimination,” we are compelled to conclude that Shetland, and only Shetland, justifies the descriptions and allusions to the “Ultima Thule” contained in the Latin classics. It consists of islands which, viewed from afar, might be mistaken for one. It lies north of the Orkneys, from some parts of which Foula the Fair Isle, or the bluff of Fitfulhead, can be seen in clear weather. A passage of six days would be a fair average in the primitive barks of the Romans, who were never much distinguished for seamanship. The more positive proofs are the Roman coins found in the country, according to Dr Hibbert (*Description of the Shetland Islands*, Edin. 1822), and the ruins of a fortification in the island of Fetlar, which the same authority declares to be a Roman camp.

It need hardly be observed that all these arguments are insufficient, and that the utmost they prove is the determination by Agricola and his men, that the venerable Thule was part of the Shetlands. Probably they saw only the loom of land to the north, and identified it with the “period of earth.” Possibly they might have been swayed by the verbal resemblance of Foula, which may be seen from the Orkneys: it is evidently Fogla or Fugla-ey, and the same desire to clear up a foggy point of geography, which made Abyssinian Bruce discover the sources of the Nile in the fountains of the Blue River, found Thule in “Fowl-isle.”^[36] The opinion, however, has found supporters. Gaspar Peucerus (*De Terræ Dimensione*) declares that the Ptolemeian Thule is to be recognised in the Shetlands, which he heard “the sailors call Thilensel” (*Fugl-insel?*). Cellarius (*Geog. Ant.*, ii. 4) discovers Thule in the island of Hjaltland (Shetland), or in the Færoe group, “quæ in eâdem fere latitudinem sunt.” He is followed by Probus (*Com. on Virgil*, ii. 358), who makes Thule the farthest of the Orcades; by the philosopher Petrus Ramus (*de la Ramée*); by Johannes Myritius, who rather cleaves to the end of Britain; by the learned Vossius, who prefers the Hebrides or Orcades; by Buchner (*Ad Tacit. Agric.*, cap. 10); by Camden, by Gosselin, and others. Stephanus Byzantinus says: “Thule insula magna in oceano sub Hyperboreas partes, ubi æstivus dies ex viginti horis æqualibus constat, nox verò ex quatuor. Hyberna verò dies à contrario.” This calculation would place Thule three degrees south of the Polar circle, and would better suit the Færoe archipelago (N. lat. 61° 23′ to 62° 26′ 40′′). Forcellini understands Cellarius also to refer to the Færoes; De Kerguelen Tremarec (*Voyages*) opines for Iceland.

IV. align="right"

THULE = SCANDIA.

It has been seen that Pliny (Nat. Hist., iv. 16) apparently separates Norway from Thule; moreover, that Ptolemy (ii. 3) confirmed by Agatharcides and Stephanus Byzantinus (lib. i., in extremis), whilst pointing to North Britain and to Scandia, or Scandinavia, in his time held to be an island,^[37] and little known to the civilised world, adds details which rather belong to Iceland. On the other hand, it is evident that during the later Roman empire, Thule was applied to Scandinavia.

Procopius, the Byzantine historian (nat. circ. A.D. 500), leaves no doubt upon this point. He devotes to it a considerable space (lib. ii., De Bello Gothico, c. 15), and his account will be little abridged. After relating how a party of Heruli, when conquered by the Longobardi, passed through the lands of the Slavini, the Varni (Οὐάρνοι, al. Harmi), and the Dani (Δάνοι, al. Dacæ), till they reached the ocean, he makes them take ship and settle at Thule:

“The island is ten times larger than Britain, and far to the north.^[38] The greater part of it is desert. The inhabited region contains thirteen great peoples, each governed by its own king. A curious phenomenon is reported from that place: every year, about the summer solstice, the sun remains forty days above the horizon. Six months after this there is a night of forty days, a time of sorrow, when all intercourse and business are at an end. I (says Procopius) was greatly desirous of seeing this marvel for myself, but the opportunity was ever wanting. I therefore asked those who had been there how the sun rises and sets. They told me that for forty consecutive days, the sun lights the island; sometimes from the east, at other times from the west; but that when he returns to the same point where he appeared, a single day is counted. During the season of forty nights, time is measured by the moon. When thirty-five of these long and lasting nights have passed, some of the people ascend the highest mountains, and give warning to those below that after five days more they will see the sun. The Thulitæ rejoice over the good news, and celebrate in the dark a festival which in ceremony exceeds all their others. Although this happens every year, still it would appear the inhabitants apprehend a total desertion of the sun.

“Amongst the barbarian peoples of Thule, none are so savage as the Skithifini (Σκιθίφιννοι, al. Scritifini). Like beasts,^[39] they ignore clothes and shoes; they drink no wine, and they eat nothing which the earth grows. Both men and women, who will not take the trouble of cultivation, occupy themselves exclusively with hunting, and the forests and mountains supply them abundantly with game. They eat the flesh, and, being without flax and wool, they wear the skins, which they fasten with sinews, having no knowledge of sewing. Also, they do not bring up their offspring like other people. The children of the Thulitæ are fed upon the marrow of beasts, instead of being suckled by their mothers. When the woman has been delivered, she wraps her babe in a skin, secures it in another, places some brains in its mouth, and sets out with her man for the chase, in which both sexes equally excel. The Thulitæ adore several gods and demons, some of whom they believe to inhabit the sky, others the air; some are on the earth and in the sea, whilst others of the smaller kind, affect the rivers and springs. They often offer sacrifices and immolate all manner of victims, the most acceptable being the first man captured in war; he is sacrificed to Mars (Thor?), the most powerful of all their gods. On these occasions they do not simply slay the victim, they either hang him to a tree, or roll him over thorns, or put him to death in some other way, choosing the most cruel.

“Such are the customs of the *Thulitæ*, amongst whom are the Goths (Γότθοι), a fecund people that gave land to the Herulian immigrants. The remnants of this race who lived amongst the Romans, after slaying their king, sent their chief worthies to the island of Thule, for the purpose of finding if any of the royal blood there remained. The deputies were successful, and chose out of many one who pleased them the most. But as he died on the way, they returned (to Thule) and brought with them one Todasius (Τοδάσιος, al. Datis); this man was accompanied by his brother named Aordus (Ἀορδός) and by two hundred youths of the island.”

This description of Thule is evidently great Scandinavia, not little Iceland. Hence Ortilius (Thesaurus sub voc.) D’Anville, who rejects Iceland; Farnaby, Schœnning (Von Nordich. Land in Neue Allg. Welt-Gesch, vol. xiii., p. 14, et seq.); Rudbeck, who understands Sweden; Murray (loc. cit.); Wedel (Alhandlung über die “Alt-Scandinavische Gesch.,” p. 32, et seq.); Schlözer (Allg. Nordisch. Gesch, pp. 14, 16), Parisot, and other geographers, have referred the descriptions of Procopius especially to the Norwegian canton still called “Tyle-mark,” or “Tile-mark.” Maltebrun (iii. 6) prefers Jutland, on the continent of Denmark, part of which, he hears, is still termed “Thy” or “Thy-land.” Calstron believed that all Scandinavia was meant. Celtes (Schardius, Basil ed., p. 59) makes Iceland “one of the isles of the ocean,” together with Scandia, Dania, Suecia, etc. Adelung (Mithridates) supports the claims of Norway. Others go as far as Lapland, and even Greenland has not been without claimants to the honour. Yet in the sixth century, Jornandes (De Origine Actuque Getarum Liber, p. 393, Basle edition of 1531), after mentioning the thirty-four Orcades, says, “Habet et in ultimo plagæ occidentalis aliam insulam nomine Thyle, de quâ Mantuanus, Italia, ‘tibi serviat ultima Thyle,’ ” and he carefully distinguishes it from the “ampla insula nomine Scanzia.”^[40]

V.

THULE=ICELAND.

It has been shown that the accounts of Pytheas, supported by details from Pliny and Ptolemy, refer only to Iceland. They are confirmed by the following authorities. In Caius Julius Solinus (A.D. 230; 2 vols. fol., Traj. ad Rhenum, 1689), we find Thule five days' sail from Orkney, and we cannot allow less than 100 knots for the δρόμος νυχθήμερος, or a total of 500 direct geographical miles; the run from northern Orkney to the south coast of Iceland being about this distance. The Polyhistor, held an oracle in the Middle Ages, adds (chap. xx., III):

"Inter multas quæ circa Britanniam sunt insulas, Thylen ultimam esse commemorat. In quâ æstivo solstitio dicit esse noctem nullam. Brumali verò perinde diem nullum."^[41]

Orosius, whose history (London, 8vo, 1773) extends to A.D. 417, says:

"Thylen per infinitum à cæteris separatam undique terris in medio sitam oceano vix paucis notam haberi."

Isidorus Hispalensis (A.D. 600-636; Orig. Seu Etym., xiv. 6; Opera Omnia, fol., Parisiis, 1601) appears to repeat Pliny:

"Thyle verò ultimam oceani insulam inter Septentrionem et occidentalem plagam,^[42] ultra Britanniam sitam esse describit, à sole nomen habentem, quia in eâ æstivum solstitium sol faciat, et nullus ultra eam dies sit. Ultra Thylen vèro pigrum et concretum mare."

The last sentence of the bishop being emphatically true in winter. Other authorities who identify Thule with Iceland, are Cluverius (Germ. Ant., ii. 39), Harduin and Dalechamp (Ad Plin.), Bougainville (c. 1, p. 152), Hill (Ad Dionys.), Penzel (Ad Strab.), Pontanus (Chorog. Dan. Descrip., p. 74), Isaac Thilo (Dissert., Lips., A.D. 1660), Gerhard Mercator, and Mannert (Geog., i., p. 78), to mention no others. Martin (Histoire des Gaules, i. 159) takes the Gauls to Iceland.

In the ninth century we have positive evidence that Thule had returned to its oldest signification, Iceland. The monk Dicuilus, who wrote in the year 825,^[43] relates that thirty years before that date (A.D. 795) he had seen and spoken with several religious who had inhabited the island of Thule between February and August. He asserts that Iceland and the Færoes had been discovered by his countrymen; and his calculation of the seasons and the days at different times of the year, together with the assertion that a day's sail thence towards the north would bring them to the Frozen Sea, shows that "Iceland, and Iceland alone, could have been the island visited by the anchorites."

The Domesday Book of the north, the "Landnámabók," whose lists of 1400 places and 3000 persons were drawn up by various authors in the twelfth century, supported, according to Mr Blackwell (note, p. 189), "by other ancient Icelandic documents," simply states (Prologus, p. 2), "Before Iceland was settled by the Northmen there were men there called by the Northmen Papæ. These men were Christians, and are thought to have come from the west, for there were found Irish books, bells (biöllur), staves (baglar), and various other things, whence it is thought that they were Westmen," Irishmen—a name still preserved in the Vestmannaeyjar archipelago. Moreover, we learn that these relics were found in Papey (the Isle of the Papæ), a rock off the

eastern coast, which still bears the same name, and at Papyli, in the interior; and finally, that “the Christians left the country when the Northmen settled there”^[44]—the latter being pragmatical pagans.

Mr Blackwell concludes that these people were probably fishermen from the north of Ireland and the Western Isles of Scotland, who may annually have frequented the northern seas, and made Papey one of their winter stations. Mr Dasent (i., vii.) more justly identifies them with the Papar or Culdees (?), a class of churchmen who have left their traces in almost every one of the outlying islands of the west. Under the name of “Papar” we find them in the Orkneys and Shetlands, the Færoes and Iceland; “and to this day the term ‘Papey’ in all these localities denotes the fact that the same pious monks who had followed St Columba^[45] to Iona, and who had filled the cells at Enhallow and Egilsha and Papa, in the Orkneys, were those who, according to the account of Dicuil, had sought Thule or Iceland that they might pray to God in peace.”^[46] These Culdees were not likely to spread, as they carried no women, but they left traces of their occupation in their cells and church furniture.

The simple story told by Dicuil is eminently suggestive. Thus Thule became, probably for a second time, one of the “Britanniæ,” the Isles of Britain; and we may consider the discovery a rediscovery, like the central African lakes, whence Ptolemy derived the Nile. When the rude barks of the eighth century could habitually ply between Ireland and Iceland, we cannot reject as unfit the Roman galleys, or even the Phœnico-Carthaginian fleets. The Periplus of Himilco was not more perilous than the Periplus of Hanno, and the Portuguese frequented the northern seas long before they had doubled Cape Horn. Bergmann had evidently no right to determine that Iceland was not “Ultima Thule,” *because*—(1.) The Romans were bad sailors; (2.) They were in the habit of writing “Rome—her mark” wherever they went, whereas no signs of their occupation are visible in Iceland; and (3.) Because Iceland was probably raised from the sea at the time when the Vesuvian eruption buried Herculaneum and Pompeii.

It is true that Roman remains have not yet been discovered in Iceland, but this is a negative proof which time may demolish; moreover, the same absence of traces characterises the Papar occupation which we know to have been a fact. On the other hand, Uno Von Troil speaks of a ruined castle near “Videdal” (Viðidalr), some 200 perches in circumference, and smaller features of the same kind on the glebe of Skeggestað, near Langanes. Mr Henderson^[47] declares of Hrutur’s cave, or rather caves—a vast apartment 72 feet long by 24 broad and 12 high, within which is a small recess 15 feet by 9, apparently a sleeping place—that both “are said to have been cut by people in former times.”

We are, then, justified in concluding that we need no longer question with Synesius, if such a place as Thule exists, or doubt with Giraldus Cambrensis, whether it has yet been discovered. We may follow A. W. Wilhelm (Germanien, etc., 1823), and believe with the Teatro Grande Orteliانو, “Islandia insula, veteribus Thyle dicta, miraculis si quæ alia clarissima.” We may agree with Mannert that Iceland might have been discovered by Pytheas the Phocæan, and even by the Carthaginians. We may even support what appears to be rather an extreme opinion:

“Pytheam præterà increpat Strabo ut mendacem, qui Hiberniam et Uxisamam (Ushant) ad occidentem ponit à Galliâ, cum hæc omnia, ait, ad Septentrionem vergant. Itaque veteres geographi Hiberniæ situm definiunt meliùs quam scriptoris seculi aurei Augusti, Himilco et Phœnices meliùs quam Græci vel Romani” (Rer. Script. Hib., prol. i., xii.).

Moreover, it appears certain that the old tradition of Thule, though different ages applied the word differently, was never completely lost; and that the Irish rediscovered the island before the

eighth century, if not much earlier, when the official rediscovery dates from the ninth, and the earliest documents from the eleventh and twelfth.

The Venerable Bede (eighth century) speaks of Iceland under the name of Thyle, more than a hundred years before its official discovery by the Scandinavians; and Alfred (ninth century), in his translation of Orosius (p. 31), assures us that the utmost land to the north-west of Ireland was called Thila, and that it was known to few on account of its great distance. Yet even after the occupation of Iceland by the Northmen, we find in the literary world the same vagueness which prevailed in earlier ages. For instance, Isaac Tzetzes (twelfth century), in his notes on Lycophron, calls the fabled Fortunate Islands of the Greeks “the Isle of Souls, a British island between the west of Britain and Thule towards the east,” which is impossible. But in the fifteenth century Petrarch has left us a valuable notice of the knowledge then familiar to men of letters (*De Situ Insulæ Thules*, epist. i., lib. iii., *De Rebus Fam.*, vol. i., pp. 136-141, ed. 1869, J. Fracassetti, Le Monnier. Florentia). In reply to his own “*Quæro quiânam mundi parte Thule sit insula?*” he quotes Virgil, Seneca, Boethius, Solinus, Isidore, Orosius, Claudian, Pliny, and Mela. He could obtain no information from “Riccardo, quondam Anglorum regis cancellario”—Richard de Bury was probably too busy for such trifles. He learned something, however, from the “*Libellus de Mirabilibus Hiberniæ, à Giraldo (Cambrensi) quodam aulico Henrici secundi, regis Anglorum.*” And after quoting this “*scriptorum cohors,*” he thus ends with “pointing a moral”—“*Lateat ad aquilonem Thyle, lateat ad austrum Nili caput, modò non lateat in medio consistens virtus,*” etc.^[48]

Icelandic Thule was advocated by Saxo Grammaticus; but his opinion was strongly opposed by his commentator (Johannis Stephani, *Notæ Uberiores in Hist. Dan. Sax. Gram. Soræ*, ed. 1644, fol.). The words of the latter’s preface are—“*Ex opinione magis vulgari, quam rei veritate Thylenses ubique nominat Saxo, qui Islandi rectius dicerentur;*” but he relies chiefly upon the controvertible arguments of “Arngrimus Jonas.” Iceland was opposed by Gaspar Peucerus (*De Terræ Dim.*), by Crantzius (*Præfatio in Norvagiam*, borrowed from Nicolaus Synesius, epist. 148); by Abraham Ortelius (*Theatrum Orbis and Thesaurum Geographicum*), and by Philippus Cluverus (*Germania Antiqua*). The globe of Martin Behaim (A.D. 1430-1506) shows a certain knowledge of details: “In Iceland fair men are found who are Christians. The custom of its inhabitants is to sell dogs at a very high rate; while they willingly part with some of their children to merchants for nothing, that they may have sufficient to support the remainder. Item. —In Iceland are found men eighty years old who have never tasted bread. In this country no corn grows, and in lieu of bread dried fish is eaten. In Iceland it is the stock fish is taken which is brought to our country.”

THULE (ETYMOLOGY OF).

Perhaps the origin of “Thule” is ground more debatable and debated than even its geographical position.

“Some,” says Sibbald, “derive the name Thule from the Arabic word Tule (طول = Túl), which signifies ‘afar off,’ and, as it were with allusion to this, the poets usually call it ‘Ultima Thule;’ but I rather prefer the reason of the name given by the learned Bochartus,^[49] who makes it to be Phœnician, and affirms that it signifies ‘darkness’ in that language. Thule (צל) in the Tyrian tongue was ‘a shadow,’ whence it is commonly used to signify ‘darkness,’ and the island Thule is as much as to say, an ‘island of darkness;’ which name how exactly it agrees to the island so called at the utmost point to the north is known to everybody.”

Others find Thule in the Carthaginian צל = “obscurity;” the Hebrew has צלל, and the Arabic ظل = obscuravit.”

After using or abusing the Semitic tongues, we come to Greek, which puts forth three principal claimants: θόλος = fuscus color, caligo; τέλος, a goal; and τηλὲ, procul. Meanwhile Isidorus (Orig. Seu Etym., lib. xiv., 6) derives Thyle, as has been shown, from the sun and its solstice. In the twelfth century, Suidas (Lex. sub voc.) makes Thulis (θούλις) a king who reigned over Egypt and the isles of the ocean, one of which was called after his name.

Etymologists presently applied themselves to the Gothic languages and their derivatives; and they did not reject geographical resemblances. Pontanus (loc. cit., i., p. 746) asserts that the islands about the Norwegian coast were generally called Thuyle. Ortelius (Thesaur. and Theatr. Orbis, p. 103), relying upon Ptolemy’s latitudes and longitudes, declares that “Thilir” was the term applied to the people of Norwegian “Tilemark;” the latter word is also written “Thulemarchia” (Johannes Gothus); “Thielemark,” “Thylemark” and “Tellemarck” (Pontanus).^[50] Not a few writers refer “Thule,” as has been said, to “Thy” or “Thy-land,” the extreme point of Jutland. The commentator on Saxo Grammaticus, before referred to, records a derivation of “Thule:”

“Quod vel instar *Tholi*, cujusdam orbis terrarum sit imposita, vel quod eo navigantes ad ploratum (tothülen Belgæ dicunt) proficiscerentur.”

In p. 175 he becomes still more vague:

“Rectius itaque Velljus nostro, juxtà ac M. Christiernus Petri, primus Saxonis interpres, reddidere Blend aff Tellœ vel Blend aff Tylœ. Quænam verò iste sint insulæ, juxtà scimus cum ignarissimis.”^[51]

Prætorius (De Orbi Goth., iii. 4, § 3) deduces “Thule” from the Gothic “Tiel,” “Teule,” or “Tuole” (= τέλος, finis), meaning a long distance, and denoting the remotest land; he doubts the existence of the place, with D’Anville (Mem. de Paris, vol. xxxvii., p. 439). Reinerus Reineccius (Reinech, Historiæ tam Sacræ quam Profanæ Cognitio, Frankf. et Lipsiæ, 1685, and Methodus Legendi, etc., Historiam tam Sacram quam Profanam, Frankf. 1670) advocates the Saxon “Tell,” meaning a limit—limes septentrionis atque occidentis. Dr Charnock compares the Saxon “Deel,” a part or portion, and quotes Wachter (Gloss. Germ.), who gives amongst other meanings of “Teil” (hod. Theil), pars, portio, segmentum, and “teilen,” i.e., dividere in partes.

Torfæus (Hist. Norwegiæ, i. 5, p. 12) proposes a variety of derivations. Wilhelm Obermüller (Wörterbuch, etc., Williams and Norgate, Lond. 1872) would explain “Thule Procopiana,” by

Dal (a dale), or “Tulla,” also written “Tolin” and “Tullin,” a meadow or pasturage; and he remarks that Norwegian “Tellemark” or “Thilemark,” is of the same descent. The Thracian Kelts had a kingdom of Tyle, which here probably signified “Dail,” a fortress. When Pliny makes men sail from Nerigos to “Thule,” the latter might have meant *Du-ile*, “the little island,” or perhaps “the dark (‘dubh,’ cloudy and wintry) isle.”

Even the orthography of “Thule” is disputed, and there are sundry variants—Thula, Thyle, Thile, Thila, Tyle, and Tila. The popular Greek form adopted by Strabo, Ptolemy, Agathemerus, Isidorus, Jornandes (De Reb. Get., cap. 1, 1), Procopius (De Bell. Goth., ii. 15) and Stephanus Byzantinus, is θούλη, which in Romaic would be pronounced “Thúle;” the ethnic being θουλαῖς (Thulæus), and θουλίτης (*plur.* θουλίται). The Latins (Mela, Pliny, Tacitus, Anonymus Ravennæ, Martianus, Solinus, etc.) seem to have preferred “Thule;” and Cluverius (Germ. Ant., iii. 39) rejects all others as barbarous. The learned and humorous Salmasius (in Solin., cap. xxii.) declares that “Thyle” ought never to be written, despite many good codices of Virgil, Pliny, Jornandes, Isidore, the Anon. Ravennæ, and others, which give Thyle and even Tyle, θύλη and θυλίτης; Æthicus (in Cosmog., p. 730), borrowing from Orosius, has “Tilæ;” Boethius (xx. 11), “Tile” and “Dyle.”

We here conclude the subject of Thule, “celebrata omnium litteris insula.” To do it full justice, and especially to quote from the “cohort” of modern writers, would require a volume.

SECTION II.

PHYSICAL GEOGRAPHY OF ICELAND.

§ 1. GENESIS AND GEOLOGY.

“Iceland owns its existence wholly to submarine volcanic agency”—such is the statement generally made by travellers and accepted by readers. The genesis of this “Realm of Frost and Fire;” this “fragment of earth white with snow, black with lava, and yellow with brimstone;” this “strange trachytic island, resting on an ocean of fire in the lone North Sea,” where the “primary powers of nature are ever at war with one another,” is compared with the efforts, vastly magnified, which in 1811 threw up from the waters Azorean Sabrina to a height of 480 feet above sea-level. And many have assumed as its exemplar the three-coned Nyöe (Nýey) that rose during the Skaptár eruption (1783), some thirty miles south-west of Reykjanes, and sank into a subaqueous reef before the end of the same year.^[52]

This is true, but not the whole truth. The basis of Iceland was recognised by Baron Sartorius Von Waltershausen to be the Palagonite^[53] which forms the foundation of volcanic tufas on Etna, the Azores, Tenerife, the Cape Verds, and other Plutonic regions. It is known to the people as “Mó-berg,” the *saxum terrestre-arenosum* of Eggert Olafsson, translated by the dictionaries Clay-soil, but generally used in contradistinction to Stuðlaberg,^[54] hard stone, the basalts, basaltites, dolerites, and others of their kind. By the older travellers, as Henderson, it is termed sandstone, and *conglomérat-basaltique*, while not a few have confounded it with trachyte. In Iceland this mineral substance, rather than mineral, is a far more important feature than even in Sicily.

By virtue of its composite character and different colour, this hydrosilicate of alumina is a Proteus; massive and amorphous; crystalline, muddy, sandy, and ashy; friable, porous, and spongy like lava and pumice; granular, silicious, and arenaceous; heavy and compact like slaty clays; vitreous and semi-vitreous with the lustre of pitch-stone. It is as various in tint as in texture; usually ferruginous brown, dark brown or dun yellow; grey and slate-coloured; dark with hornblendic particles; pure white where it is converted into gypsum, clay marl, and limonite with the aspect of chalk, by exposure to the action of sulphurous acid; green tinged with olivine; garnetic-red; ochreous, the effect of iron; and at times showing a ferreous coat of pavonine lustre. Palagonite lava is often “of so deep a brick-red colour that it resembles an iron slag, were it not for its superior lightness.”

Here, this Palagonite degrades to the yellow sand which contrasts so remarkably with the black Plutonian shore; there, in the lowlands it shows fissile strata horizontal like sandstone, and at times marly couches. It paves the soles of valleys and the floors of rivers; and it rises on the surface of the loftiest Heiðar (highland heaths), where earth is worn down to the very bone by rains, snows, and winds. Now it towers in huge cliffs and scaurs, irregular masses of rock overlying or underlying the traps; then it bulges into high belts of country, sierras and detached mountains, like Herðubreið and others which will afterwards be mentioned. Consolidated and in places crystallised by heat and high pressure, this produce of submarine volcanoes was elevated by the long continued action of quietly working forces, but it still displays its subaqueous origin. Firstly, it is a hydrate containing 17 to 25 per cent. of water; secondly, it is stratified as if

formed of hardened ashes and modified lavas; and, thirdly, it contains broken mollusks^[55] of marine types still existing, and the silicious skeletons of infusoria: a negative proof is that we never meet with it among volcanic tuffs subaërially deposited. In places it becomes an acute-angled breccia, enclosing basalts and lavas varying from the size of a pin's head to that of a man, or rounded conglomerates suggesting that the foreign matter was deposited in a shallow sea. The fresh appearance of the shells and the presence of infusoria also tend to prove that it was deposited in a heated, at least not in a gelid sea.

Professor Tyndall finds in Palagonite the first stage of the fumarole: "If a piece be heated with an excess of aqueous sulphuric acid, it dissolves in the cold to a fluid, coloured yellow-brown by the presence of peroxide of iron. On heating the fluid, the peroxide is converted into protoxide; a portion of its oxygen goes to the sulphurous acid, forming sulphuric acid, which combines with the basis of the rock and holds them in solution." But the resultant springs show no trace of oxide of iron which has been dissolved and has disappeared. "The very rock from which it was originally extracted, possesses the power of re-precipitating it, when by further contact with the rock, the solution which contains it has its excess of acid absorbed, and has thus become neutral. In this way, the aqueous sulphurous acid acts as carrier to the iron, taking up its burden here, and laying it down there; and this process of transference can be clearly traced to the rocks themselves."

Upon this Palagonite floor, the "Protogæa," or oldest formation, were laid immense tracts of sand and stratified ejections of "trap." According to Macculloch, "the word is a cloak for ignorance which saves the trouble of investigation." But it is still a general term for the older, lighter, less earthly and basic, and more crystalline forms than the basalts, containing intercalated pumice-tuffs deficient in shells, whilst the cavities abound in zeolites and amygdaloids.^[56] Concerning the strike and dip of the trap-strata, which rise sheer from the sea, in grades and layers, steep, angular, and bare, and which outline the mural copings and stepped cones of the old coast and the jaws of the river-gorges, there are many conflicting opinions. Some hold that the strata all incline gradually and quaquaversally, more or less, towards the centre of the island; whilst others find that as a rule, they are horizontal. The expedition led by Prince Napoleon (1857) recognised convergence, and often a slope of 15° towards the grand foci of eruption that form the respective systems; for instance, the *inclinaison rayonnante* towards Snæfellsjökull. The author could lay down no rule, except that the steps, viewed in profile, especially from the gashes and torrent-beds, appear to recede rather than to project, to dip inland rather than seawards. The strata vary in number to a maximum of fifty; they are perpendicular courses separated by débris, and sometimes footed by déblai and humus, disposed at the natural angle—this regularity again suggests submarine deposition, and everywhere attracts the stranger's eye.

Professor Bunsen divides the rocks of Iceland, and probably those of most other volcanic systems, into two great groups: (1.) *Normal Pyroxenic*, the basalts and dolerites, whence silica is almost absent; and (2.) *Normal Trachytic*, abounding in that mineral. The basalts^[57] are of two kinds, the true, rich in, and the basaltite, which notably wants, olivine. Both are either honey-combed with drusic cavities, or perfectly compact and fine-grained; the water-rolled pieces are soft, and smooth as marble. The basalts pass by almost imperceptible degrees into dolerites (green-stones) coloured by admixture of chlorite, and often containing iron pyrites. Of less importance as a geological feature, are the masses, veins, and crests of trachyte which pierce the Palagonites, the traps, and the basalts. The rock which is compared with the chain of the Puys (Auvergne), occurs, however, in an altered form at many places unsuspected by old

travellers, and every explorer adds to its importance. From Reykjavik appear two gold-yellow and white-streaked peaks, associated with jasper and other forms of quartz. The Snæfellsjökull peninsula is also for the most part trachytic. The celebrated Baula (the cow), a cone rising 3000 feet high, contrasts the mechanic neatness of its whitey-grey pillars^[58] with its red neighbour, Little Baula, and with the surrounding chaos of darkness; and heat-altered trachytes are found about Hekla and the Geysir. The green trachyte of Viðey, apparently tinted by chlorite, was found to contain silica, alumina, iron, and traces of magnesia. Daubeny, and a host of writers, assumed that a trachytic band, disposed upon a rectilinear fissure 200 kilometres long, bisects the island from south-west (Reykjanes) to north-east (Langanes), and represents the original Iceland, as the Longmynd and Stiper Stones are the nucleus of England. Moreover, the great centres of eruption, igneous and aqueous, were disposed upon this diagonal, flanked by the earlier Plutonic masses. Lastly, the modern volcanic chimneys were all theoretically opened in the old and new trachytic domes. M. Robert (1835) especially sought and failed to find the “trachytic band,” and, since Von Waltershausen’s visit, it has been determined that the material is the Palagonite floor traversed by the Geysir and by most of the active volcanoes.

The peculiar contrasts of the island are thus noticed by an old writer: “The king of Denmark is still master of Iceland, which is supposed to be the *Ultima Thule* of the ancients. The surface, though it is covered with snow, nevertheless contains burning mountains, whence issue fire and flames, to which the Iceland poets compare the breasts of their mistresses. It has also smoking lakes, which turn everything thrown into them to stone, and many other wonders which render this island famous.” Iceland, like Tenerife, owes its present general contour to subaërial volcanic action of the post-Tertiary period, the secular growth of the detached regions overlying the pockets and foci of eruption, as explained by Von Buch, together with the gradual accretion, the gift of exit-chimneys and dejections from the Plutonic cauldrons. The normal pyroxenic was followed by the felspathic formations, trachytic, acid and pumiceous, which, though comparatively modern, still date from immense antiquity. The distribution into fire-vents (true volcanoes) and sand-vents (pseudo-volcanoes), will be noticed in a future page.

The lava is composed of trachytic (silicious) and doleritic (basic) ejections, varying in weight;^[59] the stone averages about half the specific gravity of granite, and in a molten state it flows at the rate of 50 to 100 yards per diem. When first cooled, the ejections are lamp-black; they are then tarnished by oxygen to brown; they become grey with lichens; and finally, the lapse of ages converts them into humus. To the latter process, Brydone, on Etna, assigned 14,000 years, and greatly scandalised our grandsires, who held sound opinions upon the date (B.C. 4004) empirically assigned to creation. We can hardly forget poor Cowper’s poor verse, and poorer sense:

“Some drill and bore
The solid earth, and from the strata there,
Extract a register, by which we learn
That He who made it, and revealed (!) its date
To Moses, was mistaken in its age.”^[60]

The following is a list of the principal orographic features, Jökulls,^[61] Fells (mountains), volcanoes, masses of Palagonite, snow-peaks, and true glaciers, which are rare. Gunnlaugsson’s astronomical positions are given in Danish feet, and the former are reduced to the meridian of Greenwich by assuming Copenhagen to lie east 12° 34′ (Rafn, 12° 34′·7). The Danish foot is calculated at 12·356 inches English, or about 67:69.

The north-eastern quarter numbers fifteen points, ranging from 1000 to 3000 Danish feet, and the following ten exceed the latter:

	Dan. feet=Eng. feet.	N. lat.	W. long. (C.)=Greenwich.
Lambafell,	3459 3562	64° 58' 28''	26° 39' 19'' 14° 5'
Herðubreið,	5290 5447	65° 10' 39''	28° 58' 55'' 16° 25'
Gagnheiðarhnúkr,	3009 3098	65° 13' 35''	26° 53' 42'' 14° 20'
Beinageitarfjall,	3517 3621	65° 27' 37''	26° 42' 2'' 14° 8'
Dyrfjöll,	3606 3713	65° 31' 20''	26° 35' 17'' 14° 1'
Smjörfjall,	3859 3973	65° 36' 40''	27° 24' 6'' 14° 50'
Heljarfjall,	3991 4109	65° 48' 26''	31° 31' 56'' 18° 58'
Rimar,	4020 4139	65° 52' 45''	31° 7' 33'' 18° 33'
Ólafsfjarðarfjall,	3272 3369	65° 58' 34''	31° 31' 8'' 18° 57'
Kaldbakr,	3699 3810	66° 0' 24''	30° 48' 58'' 18° 15'

In the south-eastern quarter, nine heights range from 1000 to 3000 Danish feet, and eleven rise higher, viz.:

	Dan. feet=Eng. feet.	N. lat.	W. long. (C.)=Greenwich.
Stórhöfði,	4509 4643	63° 55' 34''	29° 17' 7'' 16° 43'
Staðarfjall,	3782 3894	63° 57' 55''	29° 12' 51'' 16° 39'
Öræfajökull, [62]	6241 6426	64° 0' 48''	20° 20' 16'' 16° 46'
Thverártindsegg,	3668 3776	64° 11' 14''	28° 46' 12'' 16° 12'
Birnudalstindr,	4300 4428	64° 14' 54''	28° 34' 1'' 16° 0'
Bakkatindr,	3316 3414	64° 20' 50''	28° 50' 22'' 15° 47'
Afrèttartindr,	3842 3956	64° 31' 4''	27° 33' 54'' 15° 0'
Búlandstindr,	3388 3488	64° 41' 54''	27° 3' 4'' 14° 31'
Snæfell, [63]	5808 5964	64° 48' 1''	28° 11' 43'' 15° 38'
Kistufell,	3499 3602	64° 51' 18''	27° 11' 16'' 14° 47'
Lambafell,	3459 3561	64° 58' 28''	26° 39' 19'' 14° 5'

In the north-eastern quarter, twenty points range from 1000 to 3000 Danish feet, and only three rise higher, viz.:

	Dan. feet=Eng. feet.	N. lat.	W. long. (C.)=Greenwich.
Illviðrahnúkr,	3476 3579	66° 8' 14''	31° 37' 4'' 19° 4'
Hvammfell,	3785 3897	65° 39' 18''	31° 48' 21'' 19° 14'
Mælifellshnúkr,	3476 3579	65° 23' 30''	31° 59' 10'' 19° 25'

In the south-western quarter, thirteen points range from 1000 to 3000 Danish feet, and again only three rise higher, viz.:

	Dan. feet=Eng. feet.	N. lat.	W. long. (C.)=Greenwich.
Snæfellsjökull,	4577 4713	64° 48' 4''	36° 25' 8'' 23° 51'
Hekla, [64]	4961 5108	63° 59' 2''	32° 19' 2'' 19° 45'
Eyjafjallajökull, [65]	5432 5593	63° 37' 2''	32° 16' 18'' 19° 42'

From these tables we see that the north-eastern and south-eastern quarters contain not only the greatest number of heights, respectively twenty-five and twenty, exceeding 1000 Danish feet, but also the apex of Iceland. The north-western, though generally a high level, has only three master peaks, and the traveller's eye soon determines the south-western to be the lowest of all. It may here be remarked that the islanders have names for the mountains, peaks, and even blocks, as well as for the valleys, whereas the Arabs, as a rule, name only their wadys.

Upon the points above named,

“Nix jacet et jactam nec sol pluviaeque resolvunt
Indurat Boreas, perpetuamque facit.”

The snow-line above the tableland (1500 to 2000 feet) varies according to position and formation of ground from 2000 to 3500^[66] feet over sea-level. The mean has been laid down at 2830 feet. Iceland, as far as it is known, contains few true glaciers. The best known of the Skriðjökklar, *glaciers mouvants*, the “vacillating jökuls” of Henderson (i., pp. 237, 265), protruded by the thrust from behind and above, are the southern offshoots of the great Klfajökull. Two have been often described—the Skeiðarárjökull and the Breiðamerkjökull. Concerning these ice masses, which are confined, as far as is known, to the southern and the south-eastern shores, and which slope gently to the sea, it is generally believed in Iceland that the congealed tracts are diminishing. Professor Tyndall observed the same in the Mer de Glace, and Mr Freshfield on the Caucasus, where the excess of consumption over supply threatens to make the “gletchers” mere spectres of their former selves.

We now approach the modern formations, the volcanic tracts which overlie the plateaux of Palagonite, trap, and trachyte, and the valleys of elevation and erosion which cleave their masses. As usual throughout the world, the fire-vents are confined to the neighbourhood of the sea and lakes: the centre of Iceland is the Sprengisandur (bursting sand),^[67] a black “Ruba’ el Kháli.” In many places the trap terraces have become a wall, over which great gushes of modern lavas have poured down towards the ocean—stone models of the waters which stream down the valleys, and which spring in cataracts from step to step.

Again, it is asserted, with premature generalisation, that the volcanic vents trend, as a rule, from north-east to south-west—a corollary of the “trachytic-band” theorem. The principal systems, which are the following, do not bear out this disposition, and it is probably true only of the south-western part of the island, which was first examined by travellers. Beginning from the north-west, we have the following list of eight great systems.

1. The Dranga^[68]-Glámu system in the great palmated projection, the former lying north-east of the latter.

2. The Leirhnúkr, Krafla, and Heiðarfjall, near the Mý-vatn Lake. They anastomose, by the Ódáða-hraun, with the Vatnajökull and the Skaptár—the direction being north to south.

3. The Snæfellsjökull (Western Jökull) runs distinctly from west to east, ending at the sea-shore.

4. The Hofsjökull, including the Arnarfells branch to the east, and the Blágnýpujökull to the south-west. Occupying the centre of the island, it approaches the Túngnafellsjökull, an outlier of the Vatnajökull system to the south-east; and westward, it almost touches the north-eastern extremity of the long Reykjanes line.

5. The Hekla system, which the old theory of fissures connected with Etna. It lies on a parallel, a Palagonite ridge about 2000 feet high, extending from west to east through the Torfajökull, to the banks of the Skaptá.

6. The Vatnajökull, whose apex is Öraefa, the whole measuring some 330 miles in circumference, and occupying an area of 3000 to 4000 square geographical miles: stretches upon a parallel, and is connected by a meridian of lava-run with No. 2.

7. The Katla, or Kötlu-gjá system, again, is not linear, but disposed in a group at the southern extremity of Iceland. The principal items are the Mýrdals, Eyjafjalla, Merkr, Goðalands, and Tindfjalla Jökulls. This great mass is generally known as the Eastern Jökull, opposed to the Western or Snæfells.

8. The Reykjanes system is apparently the only diagonal which extends from the Fire Islands north-eastwards to Skjaldbreið, and to the snow mountains, whose northernmost point is Eyriksjökull. Its items are the Láng, the Ball, the Bláfells, the Geitlands, and the Ok.

Mr Keith Johnston, sen., and other authorities, give the following list of volcanic eruptions which have occurred during the present century.^[69]

1. Aust-Jökull (an indefinite term for the great Eyjafjalla system), in December 1820 to June 1822, and January to June 1823.

2. Mýrdals Jökull (or rather Kötlu-gjá) in 1823, from 26th June, covered about a hundred square miles with sand and ashes.

3. Skeiðar Jökull began to erupt February 13, 1827, and did considerable damage. No record of this outbreak is to be found.

4. The submarine eruption off Cape Reykjanes took place in 1831.^[70]

5. Hekla, in September 2, 1845 (-46), broke out the twenty-sixth time, according to popular writers, throwing up ashes, which fell in the Orkneys, and which gave the first intelligence of the event.

6. Kötlu-gjá again was slightly active, vomiting ashes and water in May 1860, its thirteenth eruption.

7. It has been generally assumed that on March 23, 1861, the Örafajökull broke its long rest, and the smoke is said to have tarnished silver at the distance of fifty miles. But Mr Jón A. Hjaltalín, who was in Iceland during that year, denies having heard of any convulsion, nor was it mentioned by the island papers. He adds, "What is spoken of in Metcalfe's book was a 'Jökul-hlaup.' "

An ash-eruption from Trölladýngjur is recorded in 1862, but accounts of it greatly vary. Mr Keith Johnston chronicles nine eruptions extending through nearly five centuries and a half—namely, the submarine volcano in the middle of Breiði Fjörð (A.D. 1345), Trölladýngjur (1510), Herðubreið (1716-17), "Krabla" (1724-25), Leirhnúkr (1730), Síðu Jökull (1753), Örafajökull (1755), Hnappafellsjökull (1772), and Skaptárjökull (1783). And he further informs us that two great groups are active—Leirhnúkr, "Krabla," Trölladýngjur, and Herðubreið,^[71]—all nearly on a parallel of latitude to the north-east; and Hekla, Aust Jökull, Mýrdals, and Öraefa, placed in a right-angled triangle to the south.

Concerning the unvisited volcano in the snows of the Vatnajökull, all procurable details will be found in the Journal. The author was surprised to find that not one of the known centres was in a state of activity, although every preconceived idea suggested that the summer of 1872 would be one of unusual perturbation.^[72] Two days before the outbreak of Vesuvius (January 1,

1872), shocks began in the north-east of Iceland. On the afternoons of 16th and 17th April, Húsavík, a small comptoir to the east of Skjálfandi Fljót, suffered severely, as will appear in a future page. This immediately followed the fearful cyclone at Zanzibar (April 15), a phenomenon unknown in former times, which destroyed part of the town, and which sank most of the foreign and native craft,^[73] doing damage estimated at £2,000,000. The earthquake at Húsavík also took place only thirteen days after the earthquake at Antioch (morning of April 3), which shook down two-thirds of the houses, and killed nearly one-third of the people. Moreover, shocks were reported at Accra on the Gold Coast, a town which had been almost destroyed some ten years before.^[74] Followed (May 1) by the cyclone at Madras, which breached the pier, severely injured the city and suburbs, and wrecked eleven merchantmen, drowning many of the crew. Lastly came the report that the unseen crater in the untrodden snows of the Vatnajökull, whose smoke was first seen in August 1867, had again begun to “vomit flames.”

Meanwhile the eruptions of Vesuvius continued till April 26, when a new crater built a hill in the Atrio del Cavallo, where only a fissure before appeared. Professor Palmieri, who stuck staunchly and gallantly to his observatory on the banks of the new Styx, reported that the mountain was sweating fire at every pore, and that after the showers of ashes and red-hot stones, and the discharges of lava and “boiling smoke,” storms not less dangerous had begun to rage. These meteors, as a rule, occasion great floods, which, sweeping down the ashes and *rapilli* that cover the slopes, complete the ruins of the lands spared by the lava. During this eruption, a report was spread that the crater of Vesuvius had become an electric pile; that strong currents, generated by the violent ejections of the crater, showed themselves in lightnings, flashing with a dry and hissing sound from the great trunk of smoke and ashes; and, finally, that an earthquake might at any moment shake Naples to its foundation. This abnormal electricity may explain the meteorological peculiarities of the spring of 1872, even in England, where May behaved itself with the leonine violence of March. The great Pacific earthquake (August 1867) and the tremendous and unusual storm which simultaneously visited the eastern coast of South America, to quote no other instances, showed that, whilst similar effects usually are of limited extent upon solid ground, they stretch to great distances at sea, and they may influence the atmosphere in the furthest regions of the world. Though we may accept only as provisional the geological theory which places volcanoes upon fissures or solutions of continuity in the earth’s surface,^[75] we must remember that on October 17, 1755, a fortnight before the earthquake which shook down Lisbon, the Kötlu-gjá fissure began the terrible eruptions that lasted for a year: at the same time the waters of Loch Ness were agitated; the British Isles were rocked by repeated oscillations, and shocks extended to Asia and to America. Again, in 1783, the Upper Calabrian earthquake (February 5 and 7, and March 28) was closely followed by the fearful phenomena of the Skaptárjökull.^[76] Thus Nature appeared to have made in the summer of 1872 every possible arrangement for a grand pyrotechnic display; yet the author can positively assert that during the whole of his stay in Iceland not one of the twenty-seven to thirty great vents showed a symptom of activity. Indeed, only one was ever reported to be in existence, and that one has never been visited.

Professor Bunsen has shown that active volcanoes whose temperature is high, discharge sulphurous acid, whilst the dormant give forth sulphuretted hydrogen; hence the irregular and simultaneous appearance of these two gases which play a most important part in Iceland. “Let a piece of one of the igneous rocks be heated to redness, and permit the vapour of sulphur to pass over it. The oxide of iron is decomposed; a portion of sulphur unites with the iron which

remains as sulphuret; the liberated oxygen unites with the remaining sulphur, and forms sulphurous acid. Let the temperature of the heated mass sink just below a red heat, and then let the vapour of water be passed over it: a decomposition of the sulphuret before formed is the consequence; the iron is reoxydised, and the liberated sulphur unites with the free hydrogen to form sulphuretted hydrogen. Thus the presence of two of the most important agents in volcanic phenomena is accounted for. These are experimental facts capable of being repeated in the laboratory, and the chronological order of the gases thus produced is exactly the same as that observed in nature."

The most remarkable features of the island, after the volcanic, are the Fjörðs,^[77] or firths proper, conducting streams and admitting the sea; opposed to Víks and Vágrs, bights and bays, mere indentations of the coast. Though of igneous origin, they are compared with the granitic features of Norway, where a volcano is unknown, and yet where the shape becomes that of an *arête*, a fish's dorsal bone with regular ribs on both sides: this flat snow-capped ridge is "the keel" of the maritime population. The popular theory (Students' Manual of Geology, Jukes and Geikie, Blacks, Edin. 1872) is that the Fjörðs are glens once submerged, raised above water, and hollowed out by glaciers and by the various influences which come under the name of "weather." Glacial action is, we must own, distinctly traced in most parts of the island. But in many places, Berufjörð for instance, there is no room at the head of the dwarf amphitheatre for a glacier of any magnitude. As in the Færoe archipelago, these ravines are the rents and fissures which divided and fractured the first upheaval; and in Iceland they were bound together by the action of earthquakes and eruptions, ice and snow, wind and rain. The greater gorges are found chiefly on three sides of the island. The south-western shore, like that of Ireland, is digitated by gales, currents, and Greenland ice, and it abounds in "Út-ver,"^[78] the narrow-necked peninsulas of Norway. The Síða, or sea-"side" to the south-east, is a long, narrow strip of habitable land between the mountains and the waters: here the Fjörðs were obliterated by the combined action of the Jökulls. Under the name "Fjörðs" are also included immense bays, as the Faxa Fjörð, sixty-five miles across; the Breiði Fjörð, forty-five miles wide; and the Húnaflói, into which the Arctic Sea sends its unbroken swell, running forty-six miles deep and twenty-seven in diameter. The western features are, as a rule, broad, with shallow sag: here, according to some,^[79] was deposited the Surtarbrand^[80] or lignite, and, like the driftwood of Kerguelen Island, it escaped incineration by subsequent eruptions from causes analogous to the operation of charcoal burning. The northern firths are long and deeply indented, and the eastern are sharp and narrow, encased in walls of Palagonite, trap, and basalt.

The archipelagoes and solitary islands outlying Iceland are invariably small; and in places, as will be seen, the "stacks" and "drongs" form a "skerry-guard," almost a false coast.

Concerning a common feature of the interior, the Gjá (pron. *Geeow*, or like *ow* in fowl), rent, chasm, or fissure, details will be given in the course of the Journal. Here it may be mentioned that it perfectly resembles the "Ka'ah" of the Lejá and the Haurán, and the Lava Fields in the Far West of North America, which lately sheltered the "Indians," and gave so much trouble to the Federal troops.

The surface of Iceland, where free from snow, and over which men travel, may be reduced to four general formations.

1. Loose, volcanic ashey sand, grey above and black below; often mixed with pulverised Palagonite; barred with white lines of salt and potash, and either erupted subaërially or formed under water, as the rolled stones and pebbles show. This feature is found best developed in the

central and the north-eastern parts of the island; the Sprengisandur and the Stórisandur (Sahará or Great Sands) being the great examples. The hills and terraces are utterly barren, because they will not hold water: the lower levels, fed by percolation, bear the normal growth, and especially the wild oat.

2. Stone; chiefly Palagonite, trap, basalts, trachyte, lavas, and obsidians, the Μαῦρα λιθάρια of the modern Greeks. It is, however, far safer travelling than the polished limestone of the Libanus, and an hour's ride over calcareous Kasrawán is more troublesome than a day in Iceland. Its greatest inconvenience is perhaps the sun: during a clear day it becomes, in Icelandic phrase, "hot enough to make a raven gape." A fair specimen of the stone-country may be found between Reykjavík and Krísuvík.

3. Clay and humus, the former generally disposed in horizontal strata, the latter deposited by decayed vegetation upon the surface. These formations, the Geest-lands of Denmark, mostly extend round the hill feet, dividing them from the deeper levels of bog. They form essentially "rotten" ground; drilled with holes by frost, rain, and sun, and cut by gullies of all sizes, a plexus of wrinkles or gashes and earth-cracks, radiating from the highlands to the lowlands. When the path becomes a hollow way, sunk too deep for riding, rut-tracks straggle, as in the Brazil, over wide spaces and, after the vernal thaws, the traveller will find the "corduroys" of America and the "glue-pots" of Australia; whilst in places scattered stones are so many traps for careless horses. Yet these clays and humus are the best paths and, after the sands, give the fairest chance of a gallop.

4. Bog in Iceland clothes the hill-sides, as well as the bottoms and the "flats," that is, any low alluvial land: it is easily discovered from afar by the dull-red tint of iron-rust and the snow-white spangles of cotton-grass. There are two forms of profile: one lumpy, tussocky, and what one traveller calls "hassocky," like the graves of a deserted churchyard; the other a plane, the swamp pure and simple; often flooded after rains, and in the dries provided with two or three veins, into which animals plunge, struggle, and fall. These channels change so frequently that none but local guides are of use, and often the best path leads to the place which has lately become the worst. Instinct and experience do something, but not much, for man and beast: both naturally prefer running water to stagnant, and when the foremost is bogged, the followers seek a better place either higher up or lower down. On frequented lines the impassable places are provided with "Brúr," dykes or causeways of peat or stone, traversed by rude arches and flanked by shallow ditch-drains.

The Heiði, or high divide separating two river-valleys, is a "dry-land wave" (κῶμα χερσαῖον), varying from 1500 to 2000 and even 3000 feet in altitude. These ridges, especially during the mist and fog, snow and hail, wind and rain, are the horror of native travellers, and few venture upon the passage in foul weather. The profile is a harsh caricature of our Scotch and Irish moors and mosses, bogs and swamps, combining all the troubles of sand, stone, clay, and slush; whilst the marshes and drains are most troublesome to cross. "Carlines," or old women (Vörður and Kerlingar),^[81] are built in places where transit must be made at all seasons; but they are often useless, as the streams shift their bottoms, and permanent paths cannot be traced on what is neither water nor good dry land. At the beginning and end of the travelling season, snow-*fonds* and veins, based upon compressed ice, streak the slopes and dot the hollows, whilst natural arches and bridges, under which savage torrents gnash and foam, must be crossed on horseback. Concerning the behaviour of the snow, details will be found in the course of the Journal.

Roads are made in Iceland, like those of Syria, by taking off, not as in Europe by putting on, stones. In the more civilised parts of the island they are represented by horse-paths, which are occasionally repaired, and by sheep-paths, which are left to themselves: they humbly suggest the “buffalo” track of the prairie, and the elephant tunnel of the African forest. Not a few show worse engineering and tracery than those of olden Austria; hence we find upon the map such pleasant titles as Höfða-brekka^[82] (head-brink or slope), Hálsavegr (neck-or-nothing way), Íllaklif (evil cliff), and Ófæra or Úfæra, Úfærð (the untravellable)—the latter often applied to short cuts over the sea-sands where the wayfarer is exposed to a cannonade from the heights.

§ 2. HYDROGRAPHY.

The hydrography of Iceland has several peculiarities. A glance at the map shows that the Sprengisandur is the keystone of the flattened arch, which, averaging 2000 feet in altitude, forms the centre of the island. From this point the main lines diverge quaquaversally, except to the south-east, where the huge white oval, denoting the Vatnajökull, bars the way, and forms a drainage-system of its own. Hence none of the streams are navigable above the mouth, and their magnitude, as well as the dimensions of their basins, are out of all normal proportion to the area of the island. The four head rivers—Hvítá,^[83] Thjorsá, Jökulsá (western), and Skjálfjandifljót (shivering or waving flood)—range from 100 to 160 miles in length. The Thjorsá is 150 miles long, and falls 2000 feet in twenty leagues, carrying more water than the Hudson of New York. “White River” is a common local name, the effect of glacier detrition giving the milky aspect familiar to every traveller in Switzerland, and hence, probably, the muddy White Nile, as opposed to the clear Blue River. A more unusual feature is the Fúli-lækr (foul or stinking stream); the iron pyrites, where the stones are ground to powder, part with their sulphur, and the latter, uniting with the hydrogen, accounts for the unsavoury name. The Jökulhlaup, or “Snow-mountain leap,” is the sudden débâcle and exundation which spring from the congealed masses, often with the irresistible might and the swift destruction of the true avalanche.

The streams in the south-eastern corner are the shortest and the most perilous, rising full grown from the glaciers, and sweeping down fragments and miniature floes of ice. Henderson is the first English traveller who forded and described the Skeiðará and the network called the Gnúpsvötn. We may here acquit him of excessive exaggeration: the natives of the eastern coast, when travelling to Reykjavik, prefer the immense round by the north to the short cut along the southern shore; and when asked the reason, they invariably allege the dangers of the snow-drains. In the course of the Journal we shall cross two of the four head streams, and observe a water-power amply sufficient for the wants of a first-rate European people. The principal cataracts are the Oxará, the Seljaland Foss, the Goða Foss, and the Dretti Foss, first visited by Baring-Gould. All have been described by travellers, and the highest is the Hengi Foss which we shall pass on the road.

Of the lakes (Vötn), we shall inspect the two largest, the Thingvalla-vatn^[84] and the Mývatn; and we shall sight a multitude of tarns and ponds, single and grouped. One peculiarity is noticed in many of the minor waters. In Iceland it is emphatically untrue that lakes without drains are salt or briny—a rule apparently applicable only to the temperate and tropical zones. Whether the phenomenon in the north arises from subterranean drainage through the fissures of the bed, or if it be due to absence of saline matter in the area of drainage, which is often modern lava too hard to be sensibly degraded, we have no means of determining: perhaps there is a union of both causes.

A remarkable feature is the abundance of warm water laid on by the hand of Nature; the map shows upwards of two hundred; and here perhaps the hottest springs of the Old World are found. Suffice it to say at present that they are divided into two main groups. The acidulous and acid-silica, which redden litmus-paper, depositing gypsum and sulphur, do not erupt: these are the “Öl-keldur” (ale springs) mentioned in the “Royal Mirror” of the twelfth century, and they are still locally and popularly distributed into three species. Some, like “martial” waters, inebriate from the abundance of carbonic acid gas; others when allowed to stand, part with their stimulating property; and others again when filled in rise elsewhere. The second class is the alkaline-silica, which restores the colour of litmus paper; it is often explosive, and it contains chiefly sodium and silica. In the valley of the Yellowstone River the springs are either (1.) Calcareous (alkaline), depositing carbonate of lime with sulphates of magnesia and soda, chloride of calcium, and a little silica; or (2.) Silicious (acid), containing 85:100 silica, chloride of magnesium, and only a trace of lime.

The Geysir (gusher)^[85] is a spouting spring; the Reykirs (reekers) give forth steam; the Laug is a warm fountain which may serve as a bath; the Náma^[86] (hole of hot water) is sulphurous and gaseous; the Hverr (cauldron), like its smaller congener the Ketill (kettle), is a tranquil, hot, and even boiling well or pool, it is also applied to mud springs; and the Makkaluber (the Italian “Salsa,” or “Hofetta,” and the American “Mud-puff”) is a miniature volcano of hissing, boiling bolus. Further details concerning the names and natures of these features will be given in the Journal.

§ 3. CLIMATE.

The “cold of Iceland” is as proverbial as the “deserts of central Africa,” and both sayings are equally based upon unfacts. “Iceland, where the cold and winter are perpetual, and the cold scarce to be endured,” is what we read. But those who travel in the island find—(1.) that even in winter the temperature is rarely severe; (2.) that there are two distinct climates, on the north coast and in the southern country; and (3.) that the air, however unpleasant, is exceptionally wholesome.

1. The isotherms by no means follow the circles of latitude. The cold lines swerve away from, instead of passing through, Iceland, and show none of that severity which characterises Greenland and the northern parts of British America. As has long ago been observed,^[87] the isotherm of F. 32°, the freezing point of water, which is that of Akureyri, varies 14° between southern Asiatic Russia (N. lat. 56°) and northern Norway (N. lat. 70°).

The mildness of the insular climate, and that of the easterly winds, which are too clear to come from warmer waters, are popularly attributed to the “great Gulf Stream.” This sea-river, we are told, “sweeping up from the south, brings with it a store of heat to bless the islanders, and so materially affects the island that in the south of Iceland the winter is not more severe than in Denmark.” The Gulf Stream is generally supposed to strike the south-western angle, and to flow along the southern shores; while others make it bifurcate off Reykjanæs, hence one part subtends the north-western point or Land’s End of Iceland, where it meets the Polar and Arctic current, the other half embraces the southern shore, and both meet in the north Atlantic arm separating Iceland from Norway. Dufferin’s map shows the popular belief: the true Florida current, sweeping past the southern shore of Iceland, forks about Spitzbergen, sending off a branchlet to the west, and ends south of Novaya Zemlja. On the other hand, Dr Carpenter contends that the real “River in the Ocean” dies out in the mid-Atlantic. According to Dr Joseph

Chavanne of Vienna (Mittheilungen, No. vii., 1874), the northern arm of the Gulf Stream, which flows between Bear Island and Novaya Zemlja, touches the northern coast of Asia, and eastward of the New Siberia Islands joins the western drift of the Kurosiwo. The other northern branch, which subtends the western coast of Spitzbergen and the Seven Islands, is submerged between the Polar currents, to reappear at the surface farther northward, and thence to lave the shores of the Arctic continent: the latter is thus washed by two warm streams, rendering the existence of perennial ice a sheer impossibility.

We may fairly question the existence of the Gulf Stream along the southern Icelandic shore, and doubt its bifurcation and subsequent reunion. This is not the place to discuss the subject of ocean circulation, a “discovery equal to that of the circulation of the blood,” first made by Professor Lenz of St Petersburg in 1845, based upon the second voyage of Kotzebue in 1823-26, and independently by Dr Carpenter during the cruise of the “Porcupine” (1869). Their aqueous movement corresponding with the aerial; and the mass of thermal equatorial waters travelling towards the poles, whilst the counter current sets in the inverse direction, would account for many phenomena yet unexplained, but it is still *sub judice lis*.^[88] We may remark that the comparatively shallow seas between the British Islands and Iceland must accumulate heat, and that this fact perhaps suffices for what has been attributed to the Gulf Stream and to the general circulation. Thomas Bartolin (Acta Medica Havn. ad annum 1673) mechanically explains away the necessity of the former: “Aqua Insulas Ferroenses allabens, quamquam per se frigida sit, salsitudine tamen suâ, ex perpetuo motu, plerumque producit hyemem temperatam.” Hence the waters of Niagara are colder above than below the falls, and the ocean is warmer after a storm.

Practical men, especially mariners, in Iceland vigorously deny the existence of the Gulf Stream.^[89] Captain Tvede, an intelligent and observing Dane whom we shall meet in the eastern regions, considers that the theory, like judicial phrenology and a host of pseudo-sciences, became popular because it generalises, formalises, and simplifies facts. He declares that a Gulf Stream, if it existed, would entangle the Greenland icebergs, and carry them to the southern coast of Iceland, which never happens. He asserts that a few miles south of Ingólfshöfði the Sea River is still warm, but that instead of striking the shore it trends directly north-eastwards to western Norway, sweeps round the continental North Cape, and here meets the icebergs from Spitzbergen and Jan Mayen. He has found himself in an ice-dock floating in water which showed 35° F.

Captain Tvede kindly gave me the following series of observations:

1. June 19, 1867: thermometer in water 46° F. outside of Hrollaugseyar, 6 miles east of Ingólfshöfði, 48° F. 3 miles south-east of ditto, and 47° F. 20 miles west of ditto.
2. June 20: thermometer 47° between Portland and the Vestmannaeyjar, 47° F. 12 miles west of the Vestmannaeyjar.
3. June 23: thermometer 46° in the Breiði Fjörð, off Stykkishólm.
4. June 24: 43° outside of the Dýrafjörð, and 43°-43°·50 outside of the Ísafjörð.
5. June 25: 38° off the Húnafljóí, and 43° off Cap Nord.
6. July 1: 40° off the Axarfjörð.
7. July 4: 39° off the Langanes (north-eastern point of Iceland).
8. July 6: 40° off Viðivík, and 42° outside of Borgarfjörð.
9. August 4: 46° 16 miles south-east of Langanes.
10. August 6: 42° in the Testilfjörð, western side of Langanes.
11. August 10: 38°·50 off Hornnes, and 39° same day off Gerpir, 4 miles south of Hornnes.
12. August 19: 44° off Dalataur, entrance of Syðisfjörð.
13. August 21: 44° off Héradsflói.
14. August 22: 42° to north, with Kollumúli bearing south-west, 44° at sea.
15. September 1: 41° off Berufjörð.

The subjoined figures are the means of observations taken every fourth hour on board the “Jón Siggurðsson” steamer, in which the author voyaged (June 26 to August 5, 1872) between Hafnarfjörð and Grafarós:

Air.	Water.
1. 12° (C.=53°·6 F.)	10° (C.=50° F.) at Reykjavík.
2. 11° (C.=51°·8 F.)	8°·5 (C.=47°·3 F.) at Flatey.
3. 13° (C.=55°·4 F.)	9° (C.=48°·2 F.) at N. lat. 66°30', W. long. (G.) 24°.
4. 9° (C.=48°·2 F.)	5°·8 (C.=42°·4 F.) at N. lat. 66°10', W. long. 23°12'.
5. 14°·5 (C.=58°·1 F.)	8°·8 (C.=47°·8 F.) at Borðeyri.
6. 14°·5 (C.=58°·1 F.)	8°·3 (C.=46°·9 F.) at Grafarós.
7. 11° (C.=51°·8 F.)	6°·8 (C.=44°·2 F.) at Cap Nord.
8. 11° (C.=51°·8 F.)	8°·5 (C.=47°·3 F.) at N. lat. 65°8', W. long. 23°24'.

Both series tend to show the capricious variation of temperature (from 38° to 48° F., and from 48°·2 to 58°·1 F.), where the summer sea is subject to the influx of a little snow-water, and none of the regularity which might fairly be expected from a “gulf-stream.”

2. Every book of travels from Horrebow and Mackenzie to the present day, has given notices of the climate of Iceland.^[90] The mean temperature of the Iceland year between 1828 and 1834, has been laid down at 3°·42 Reaumur (= 39°·7 F.). The annual average of Copenhagen is assumed at 46°·8 (F.); the maximum, observed in the shade, being 94°, and the minimum about 19° (F.). That of Montreal stands at 6°·30 Reaumur (= 46°·2 F.). The winters in Iceland are colder than in Montreal in October and November (both included); warmer from December to March, and again cooler from April to December. Eyjafjörð (N. lat. 65° 40') is more genial than Cumberland House (N. lat. 53° 57'), and much warmer than any place in its own parallel. The almost nightless summers from June to August, which must affect the respiration of plants, gather caloric, and the sun at that season fails to heat only at a very obtuse angle, when the rays are intercepted by a thicker column of air. The equatorial current which prevails in occidental England for eight or nine months during the year, as the south-wester in Iceland, must greatly modify the climate. Old travellers assure us that the sub-surface is frost-bound throughout the year; this takes place only after a succession of hard winters and ungenial summers—even the cellars are rarely frozen in winter if care be taken to close the doors. Mr Vice-Consul Crowe (first Report on Iceland, 1865-66), asserts that “the average temperature of the earth is about 4½° Reaumur all the year round.”

Reykjavik, the capital of Iceland (N. lat. $64^{\circ} 9'$), enjoys a more genial climate than any place whose temperature is recorded between the parallels of 55° and 85° (N. lat.), except only St Petersburg (N. lat. $59^{\circ} 56'$) and Sitka Sound (N. lat. $57^{\circ} 3'$). The mean of the year is but 1° (F.) less than that of St John's, which lies 16° farther south. The winter corresponds with that of Illukuk, 10° to the south, and the summer is much hotter. Humboldt's mean temperature, 40° F., is generally adopted, although some reduce it to $39^{\circ} \cdot 4$, and even to 39° . He makes February, the coldest month, average $28^{\circ} \cdot 22$, and July, the hottest, $56^{\circ} \cdot 3$ —a difference of over 28° , which others reduce to 27° . He fixes the winter mean at $29^{\circ} \cdot 1$; the spring at $36^{\circ} \cdot 9$; the summer at $53^{\circ} \cdot 6$ (in Berghaus' Atlas, 50°); and the autumn at $37^{\circ} \cdot 9$. Dillon (pp. 167, 168), during the severest season of half-a-century, saw the mercury as low as 10° (F.), in February; and Pliny Miles (p. 55) declares that the thermometer seldom falls below 12° or 18° .

It will be remembered that the annual mean of climates, where civilisation is highest, represents in Europe 52° (F.), and the zone is 15° north and south of N. lat. 40° , an undulating belt of 30° arching towards the equator and the poles. Including its protraction eastward and westward, it contains 95/100ths of the white races, and almost all the greatest development.

Certain valuable "notes on the distribution of animals available as food in the Arctic regions," compiled by Herr Petermann, and published in the Journal of the R. Geog. Society (vol. xxii.), enable us to compare the thermometer in the south and in the north of the island. "Reykiavig" (N. lat. " $64^{\circ} \cdot 08'$ ") is placed between New Herrnhut and Fort Reliance, whilst Eyjafjörð (N. lat. $66^{\circ} 30'$), stands between Fort Hope and Winter Island.

The figures are as follows:

	Spring.	Summer.	Autumn.	Winter.	Annual mean.	Difference Sum. & Wint.
New Herrnhut,	$26^{\circ} \cdot 15$	$39^{\circ} \cdot 28$	$26^{\circ} \cdot 50$	$14^{\circ} \cdot 30$	$26^{\circ} \cdot 83$	$24^{\circ} \cdot 48$
1. <i>Reykjavik</i> ,	$37^{\circ} \cdot 04$	$53^{\circ} \cdot 54$	$37^{\circ} \cdot 94$	$29^{\circ} \cdot 18$	$39^{\circ} \cdot 43$	$24^{\circ} \cdot 36$
Fort Reliance,	"	$12^{\circ} \cdot 21$	"	$-16^{\circ} \cdot 97$	$16^{\circ} (?)$	"
Fort Hope,	$-4^{\circ} \cdot 73$	$39^{\circ} \cdot 59$	$13^{\circ} \cdot 93$	$-25^{\circ} \cdot 09$	$5^{\circ} \cdot 96$	$64^{\circ} \cdot 68$
2. <i>Eyjafjörð</i> ,	$28^{\circ} \cdot 10$	$45^{\circ} \cdot 80$	$34^{\circ} \cdot 46$	$20^{\circ} \cdot 84$	$32^{\circ} \cdot 30$	$24^{\circ} \cdot 96$
Winter Island,	$6^{\circ} \cdot 35$	$31^{\circ} \cdot 80$	$17^{\circ} \cdot 58$	$-20^{\circ} \cdot 47$	$8^{\circ} \cdot 82$	$52^{\circ} \cdot 27$

Ranged according to seasons and months, the figures stand:

SPRING.						
New Herrnhut	in February (coldest),	$22^{\circ} \cdot 10$	in March	$21^{\circ} \cdot 65$	in April	$24^{\circ} \cdot 80$
<i>Reykjavik</i>	"	$28^{\circ} \cdot 31$	"	$29^{\circ} \cdot 86$	"	$36^{\circ} \cdot 46$
Fort Reliance	"	$-18^{\circ} \cdot 84$	"	$-6^{\circ} \cdot 14$	"	$8^{\circ} \cdot 23$
Port Hope	"	$-26^{\circ} \cdot 68$	"	$-28^{\circ} \cdot 10$	"	$-23^{\circ} \cdot 95$
<i>Eyjafjörð</i>	"	$18^{\circ} \cdot 50$	"	$20^{\circ} \cdot 66$	"	$27^{\circ} \cdot 50$
Winter Island	"	$-23^{\circ} \cdot 99$	"	$10^{\circ} \cdot 72$	"	$6^{\circ} \cdot 48$

SUMMER.						
New Herrnhut	in May,	$32^{\circ} \cdot 0$	in June,	$40^{\circ} \cdot 10$	in July, (hottest),	$40^{\circ} \cdot 33$
<i>Reykjavik</i>	"	$44^{\circ} \cdot 80$	"	$51^{\circ} \cdot 58$	"	$56^{\circ} \cdot 19$
Fort Reliance	"	$36^{\circ} \cdot 03$	"	"	"	"
Fort Hope	"	$17^{\circ} \cdot 88$	"	$31^{\circ} \cdot 38$	"	$41^{\circ} \cdot 46$
<i>Eyjafjörð</i>	"	$36^{\circ} \cdot 14$	"	$43^{\circ} \cdot 52$	"	$46^{\circ} \cdot 94$
Winter Island	"	$23^{\circ} \cdot 29$	"	$23^{\circ} \cdot 17$	"	$35^{\circ} \cdot 36$

AUTUMN.

New Herrnhut	in August	37°·40	in September,	34°·03	in October,	32°·90
<i>Reykjavik</i>	"	52°·86	"	46°·45	"	36°·91
Fort Reliance	"	"	"	"	"	20°·70
Fort Hope	"	46°·32	"	28°·57	"	12°·56
<i>Eyjaflörð</i>	"	46°·94	"	43°·16	"	34°·34
Winter Island	"	36°·86	"	31°·61	"	13°·25

WINTER.

New Herrnhut	in November,	15°·80	in December	11°·75	in January	9°·05
<i>Reykjavik</i>	"	30°·45	"	29°·41	"	29°·82
Fort Reliance	"	13°·44	"	-17°·07	"	-25°·00
Fort Hope	"	0°·68	"	-19°·27	"	-29°·32
<i>Eyjaflörð</i>	"	25°·88	"	18°·32	"	25°·70
Winter Island	"	7°·88	"	-14°·24	"	-23°·17

Dr Joseph Chavanne, before alluded to, gives the following table of the wind temperature at Reykjavik, showing the deviations from mean:

WINTER.—MEAN TEMPERATURE -1·8.

N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	MAX.	MIN.	DIFF.
3·6	-2·2	+1·3	+4·1	+3·7	+1·1	-1·4	-2·9	E. 68,	S. +4·4	N. -3·68·0

SUMMER.—MEAN TEMPERATURE +11·0.

0·0+0·5+0·1+0·2+0·3-0·7 -1·0-1·3 E. 30, S. +0·7 W. 35, N. -1·62·3

Thus the climate of southern Iceland is insular and not excessive. We have a notorious instance of the same disposition in England. With us Devon represents the south-western coast of Iceland, and justifies Carrington's high praise:

"Thou hast a cloud
 For ever in thy sky; a breeze, a shower
 For ever on thy meads. Yet where shall man,
 Pursuing spring around the globe, refresh
 His eye with scenes more beauteous than adorn
 Thy fields of matchless verdure?"

The northern climate of Iceland, distant only 3° or 180 direct geographical miles, is distinctly continental; the difference ranging between 14° and 17° (F.). This is easily accounted for by the Arctic current, by the proximity of Polar ice, and by the prevalence of northern and north-western winds, which, in south Iceland as in Palestine, drive away rain. Whatever discrepancy of opinion there may be concerning the Gulf Stream, there can be none about the cold drift which, between Greenland and Iceland, measures some fifty miles in breadth, and many hundred feet in depth. Hence the north-western digitations are more subject to flocs and bergs than the Breiði Fjörð, which again is oftener invested than the Faxa Fjörð, the latter being rarely beset more than once during the century. According to Uno Von Troil, the sea-ice, now so rare, came regularly in January with the north-eastern gales, and was never far from the north-east coast. At present the season is about April and even later.

In the north, according to Metcalfé (p. 152), the winter is much keener, and the summer is proportionally milder than in the south; some observers deny the truth of the latter part of the proposition, and make the hot months average about the same figure. The snow often begins with October and lasts till mid-May when the temperature stands at a mean of 35° (F.). For Akureyri Baring-Gould (quoting the Almanak um Ár 1863), gives the year as 32° (F., freezing point = Eyjaflörð), the

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